Vol. VII.
No. CLVII.

AUGUST 15, 1879.

Price
Fourpence.

THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW.

LONDON: HAUGHTON & COMPANY, 10, PATERNOSTER ROW, E.C.

JOHNSON & PHILLIPS,
TELEGRAPH ENGINEERS, ELECTRICIANS, & CONTRACTORS.
OFFICE: 16, UNION COURT, OLD BROAD STREET, LONDON, E.C.
WORKS: VICTORIA ROAD, CHARLTON, LONDON, S.E.

Manufacturers of all Telegraph Appliances, Materials, and Machinery for Making and Laying Submarine Cables, and Contractors for Underground & Aerial Telegraphs.

Iron Telegraph Buoys, Grapnels, both Patent and Ordinary; Centipedes, Creepers, Mushrooms, Sinkers, Cable Tanks, Picking-up and Paying-out Machinery, Dynamometers, Bow and Stern Gear, Steam and Hand Hauling Gears, Rope and Chain Fittings, Cable Drums, Splicing and Jointing Tools, &c., &c.

Machinery Designed and Constructed for the Complete Equipment of Telegraph Cable Factories and Vessels. Wire Testing Machines for Tension, Elongation, and Torsion. Special Wire Sounding Machines for Shallow and Deep Water.

All Apparatus and Material used in the Construction and Maintenance of **LAND LINES, viz.:—**

INSULATORS—*Johnson & Phillips's* Patent Fluid Insulators, and all kinds of the ordinary form.
BATTERIES—Sole Makers of *Higgins'* Patent Bichromate Batteries, and all the ordinary forms. Contractors or the supply of Zinc and Carbon Battery Plates of special quality.
POLES—Wrought Iron or Composite Poles of various kinds.

MAKERS OF SPECIAL UNDERGROUND TORPEDO AND FIELD CABLES, WITH SINGLE OR MULTIPLE CORES.
Insulated Copper Wires, Strand and Ropes, taped or braided, for Electric Lighting purposes, also Carbon Rods.
ESTIMATES GIVEN FOR COMPLETE SYSTEMS OF ELECTRIC LIGHTING.
LIGHTNING CONDUCTORS ERECTED, TESTED AND MAINTAINED.

ELECTRIC LIGHT.

SIEMENS BROTHERS,
TELEGRAPH ENGINEERS,
MANUFACTURERS OF
SIEMENS' PATENT DYNAMO-ELECTRIC MACHINES, LAMPS, CARBONS, and all APPARATUS NECESSARY FOR WORKING THE ELECTRIC LIGHT FOR LIGHTING RAILWAY STATIONS, WHARVES, DOCKS, LIGHTHOUSES, SHIPS, FACTORIES, WEAVING SHEDS, YARDS, &C.

Manufacturers of Submarine Cables, Materials for Overground Lines, Iron Telegraph Posts, Insulators, Instruments, Batteries, Electric Mine Exploders, and Telegraph Apparatus of all kinds.
Contractors for laying Submarine Cables, for the erection of Land Lines, and for the establishment of Telegraphic communication generally.

Offices—12, QUEEN ANNE'S GATE, WESTMINSTER.
Works—CHARLTON PIER, WOOLWICH, KENT.
And at BERLIN, PARIS, St. PETERSBURG, and TIFLIS.

THE
TELEGRAPHIC JOURNAL
AND
ELECTRICAL REVIEW.

VOL. VII. AUGUST 15, 1879. No. CLVII.

CONTENTS:

PAGE
The Reserve Funds of the Cable Companies 257
Bright's Type-Printing Telegraph (*illustrated*) 257
New Telephone Calls (*illustrated*) 259
The Telegraph in Denmark, by Carl Hansen 260
The New Cable Steamer 262
The Rise of the Thermo-pile (*illustrated*) 262
Correspondence 265
Notes 265
Review 268
New Patents—1879 269
General Science 270
City Notes 271

TO INVENTORS.

MESSRS. BREWER & JENSEN, British, Foreign, and Colonial Patent Agents, give prompt personal attention to all matters intrusted to them. Office for Patents, 33, Chancery Lane, W.C. Established 1844.

PATENTS FOR INVENTIONS.

ROBERTSON, BROMAN, & Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet, containing special advice, gratis or by post. 166, Fleet Street, London.

GEOLOGY.—In the Preface to the Student's ELEMENTS of GEOLOGY, by Sir Charles Lyell, price 9s., he says:—"As it is impossible to enable the reader to recognise rocks and minerals at sight by aid of verbal descriptions or figures, he will do well to obtain a well-arranged collection of specimens, such as may be procured from **Mr. TENNANT** (149 Strand), Teacher of Mineralogy at King's College, London." These Collections are supplied on the following terms, in plain Mahogany Cabinets:—

100 Specimens, in Cabinet, with 3 Trays	£2	2	0
200 Specimens, in Cabinet, with 5 Trays	5	5	0
300 Specimens, in Cabinet, with 9 Drawers ..	10	10	0
400 Specimens, in Cabinet, with 13 Drawers ..	21	0	0

More extensive Collections at 50 to 5,000 Guineas each.

HARBOROW & Co.,
ELECTRIC TELEGRAPH ENGINEERS,
CONTRACTORS AND MANUFACTURERS,
4, Circus Street, Marylebone, W.

Makers of Block Instruments, Single and Double Needle Instruments, Coils for same with Induced Needles. Lines constructed and maintained. Batteries of every description. Electric Bells, Indicators, Thief and Fire Alarms for private houses, banks, hotels, warehouses, &c., &c. Lightning Conductors. All kinds of Electrical Mining Apparatus. H. and Co. draw attention to their Bells, &c., especially adapted for mines. Models made. Experiments carried out.—4, Circus Street, Marylebone, London, W.

MACHINERY for covering Telegraph Wire with Silk, Cotton, Flax, Hemp, India-Rubber, Gutta-Percha, &c. Wire Stranding Machines. Complete sets of Machinery for the Manufacture of Telegraph Cables.
THOS. BARRACLOUGH, 97, BRIDGE STREET, MANCHESTER.

TELEGRAPH CONTRACTORS (Home or Foreign) can be supplied with every description of Cabinet Work, at WM. M. FOXCROFT'S TELEGRAPH CASE MANUFACTORY, 54, COMPTON STREET, CLERKENWELL, E.C. Single and Double Needle Instrument Cases, Disc Cases, Morse Boards, and Bell Cases always in Stock. Teak Cases for Station Clocks made to order. Microphone Boards of any pattern. Tenders given.

JUST PUBLISHED,
240 pp., with 94 Illustrations, demy 8vo., cloth, 9s.

THE ELECTRIC LIGHT
IN ITS PRACTICAL APPLICATION.
BY PAGET HIGGS, LL.D., D.Sc., Asso. M. Inst. C.E.

CONTENTS:

INTRODUCTORY—Lamps or Burners employing the Voltaic Arc—Electric "Candles" and Candle Lamps—Lighting by Incandescence—Magneto and Dynamo-Electric Machines—Mechanical Efficiency of Electric Light Machines—Simple Mathematical considerations concerning Electric Lighting—Electric Regulators—Commercial Aspect of Electric Lighting—Division of the Electric Light—Maritime and Military Applications—Various Applications of the Electric Light—Electric Carbons.

London: E. & F. N. SPON, 46, Charing Cross.

BLOCK TELEGRAPHS AND ELECTRIC INTERLOCKING SIGNALS.
TYER & COMPANY

Respectfully invite the attention of Railway Directors, Managers, and Engineers to their important improvements in "Block" Telegraphs, especially to their new system (Patent 1874, in conjunction with Messrs. SAXBY & FARMER), inspected and improved by Captain TYLER, on behalf of the Board of Trade. By the use of this appliance, a signalman who receives a telegraphic indication of a line blocked from the signalman in advance, cannot possibly give a contrary signal upon the outside semaphore to the engine-driver.

"Such is the latest development of railway signalling, which is worthy of careful attention, constituting, as it does, a marked advance upon the ordinary block system."—*The Times.*

Office and Works—4, OLD STREET, GOSWELL ROAD, LONDON.

TELEGRAPH INSTRUMENT CASES.

GEORGE BEECH,
10, SANDRINGHAM RD., HIGH ST.,
KINGSLAND,

Continues to supply Railway and Telegraph Engineers with every description of Telegraph Instrument Cases, Single Needle, Block, Bell, Switch, &c. The material and workmanship of first quality and guaranteed.

Terms moderate for Cash.

ELECTRIC LIGHT.

THE INVENTOR of a valuable system for Electric Lighting, patented in England and abroad, desires to meet with a gentleman of means, to assist him in working said patents, or to purchase same. Address C.C., care of Editor, *Telegraphic Journal.*

THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW,

Handsomely bound in cloth, gilt, Vols. I., II., III., IV., V., and VI. Price 10s. 6d. each. Nearly all the back numbers may be had through any Bookseller, or of the Publishers. Subscribers' numbers bound in black cloth, gilt, 2s. 6d. Binding Cases, 2s.

HAUGHTON & CO., 10, PATERNOSTER ROW, E.C.

THE

"EMPRESS" WATER MOTOR

Price List and Power of the "Empress" Motors at Various Pressures, April, 1879.

No.	Size of Jet.	Diameter of Wheel.	20 to 40 lbs. Pressure H.-P.	40 to 60 lbs. Pressure H.-P.	60 to 80 lbs. Pressure H.-P.	Consumption of Water per Hour. 20 to 40 lbs. Pressure Galls.	Consumption of Water per Hour. 60 to 80 lbs. Pressure Galls.	Size of Driving Pulley.	Size of Supply Pipe leading up to Jet.	Pipe to Carry Waste Water away.	Revolutions per Minute.	Price of Motor, with Jet.
2	3-32 in.	11 in.	For Sewing and other Light Machinery.			40 to	70	2½ in. gut.	¾ in.	1 in.	1000 to 3000	£3 3s.
3	3-32 in.	14 in.				40 to	70	3¾ in. gut. diam. width.	¾ in.	1 in.	900 to 2500	£4 10s.
4	3-16 in.	18 in.	¼ to ½	½ to ¾	¾ to 1	150 to 200	250 to 350	5 in. 2½ in.	1¼ in.	2½ in.	800 to 2000	£8 0s.
5	3-16 in.	23 in.	½ to 1	1 to 1½	1½ to 2	150 to 200	250 to 350	7 in. 2⅝ in.	1½ in.	2½ in.	600 to 1500	£15 0s.
6	¼ in.	30 in.	1 to 2	2 to 3	3 to 4	300	500	9 in. 2¾ in.	2 in.	3½ in.	400 to 1200	£25 0s.
7	2 of $\frac{3}{16}$ in.	2 of 30 in.	2 to 3	3 to 4	4 to 5	400	700	9 in. 2¾ in.	2½ in.	5 in.	350 to 1000	£35 0s.
8	2 of ¼ in.	2 of 36 in.	3 to 4	4 to 5	5 to 6	600	1000	9 in. 2¾ in.	2½ in.	6 in.	300 to 900	£45 0s.

MANUFACTURED ONLY BY

E. S. TAYLOR & CO.,

WORKS—111 & 113, BLANDFORD STREET,
OFFICES—9 & 10, SHEFFIELD BUILDINGS, 89, VICTORIA STREET, } LIVERPOOL.
" METROPOLITAN BUILDINGS, QUEEN VICTORIA STREET, LONDON.

A. COMBE & CO.,

31 & 32, KIRBY STREET, HATTON GARDEN, LONDON.

MANUFACTURERS OF SCREWS

OF ALL KINDS, AND SMALL WARES FOR

Electrical, Telegraphic, Optical, Scientific, Philosophical, Surgical, and Musical Instruments.

ENGINEERING, &c., &c. TURNERY IN ALL METALS.

First-class work guaranteed. Estimates on application.

ELECTRIC HOUSE BELLS.

BURGLAR DETECTORS. FIRE ALARMS.

Electric Bells on the best system from 8s. 6d. each.

INDICATORS with Improved Mechanism. CONSTANT BATTERIES. WOOD & CHINA PUSH BUTTONS. INSULATED WIRE.

HOUSES & MANSIONS FITTED. ESTIMATES GIVEN.

ILLUSTRATED CATALOGUES with Diagrams, enabling everyone to fix their own Bells, Post free.

"MESSRS. ARCHBUTT, **TESTIMONIAL.** "RUGBY, *May*, 1878.

"Your Electric Burglar Detectors fitted in my house last month have already proved efficient."

PROFESSOR HUGHES' MICROPHONE, price complete, with 3 Cell Battery and Instructions, 13s.

Magnets of all descriptions. Silk covered Wire. Binding Screws, 3s. per dozen. Double Line Wire 1s. 6d. per dozen yards. Silk Cord, Switches, &c., &c. Telephone Signal Transmitters, 10*s*. 6*d*. each.

The Tourist's Friend:—A PEDOMETER, registering distance walked, price 16s., post free in Great Britain and Ireland.

J. & W. E. ARCHBUTT,

8, BRIDGE STREET, WESTMINSTER S.W.

FACING THE HOUSES OF PARLIAMENT.

NEWALL'S PATENT LIGHTNING CONDUCTORS.

Experience, accumulated since the time of Benjamin Franklin, proves conclusively that a Conductor made of Copper, of adequate size, is the best of all appliances for the protection of every description of Building from the destructive effects of Lightning.

NEWALL & CO.'S PATENT COPPER-ROPE LIGHTNING CONDUCTOR,

As applied to all kinds of Buildings and Shipping in all parts of the world with unvarying success, is the most reliable, most effective, and cheapest conductor offered to the public.

It is simple in its application, no insulators being required; and it costs only ONE SHILLING per foot for the standard size, which is safe in any storm.

SOLE PATENTEES OF UNTWISTED WIRE ROPE.

Manufacturers of Iron and Steel Ropes for Colliery and Railway Purposes. Rigging Ropes, Guide Ropes, &c.

GILT AND SILVER CORD FOR HANGING PICTURES. IRON, STEEL, AND COPPER CORD FOR CLOCK AND SASH LINES, &c.

R. S. NEWALL & Co., LONDON, 130, STRAND, W.C.

LIVERPOOL, 36, Waterloo Road; GLASGOW, 68, Anderston Quay; MANUFACTORY, Gateshead-on-Tyne.

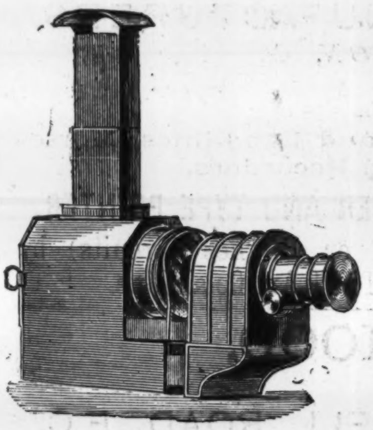
THE SCIOPTICON.

An improved form of Magic Lantern, burning paraffin oil, and giving a powerful light up to an 8 or 10 feet disc.

THE SCIOPTICON was the first of these lanterns introduced, and still holds its place as the best among a host of imitations.

The principle of the light is two *parallel* flames placed edgewise to the condenser.

Always ready—a few seconds only required to put in operation.



The **Improved Sciopticon** is the only Lantern in the market constructed on scientific principles. It is arranged so that the whole of the light from the condensers passes through the front lenses, the focussing being done *with the slide*, thus giving a greatly increased light on the screen and much better definition. **Price £6 6s.**

Catalogue of Sciopticons and Appliances.

SCIOPTICON MANUAL OF INSTRUCTIONS AND EXPERIMENTS. 13 Stamps.

Fourth Edition in the Press.

WOODBURY LANTERN SLIDES.

Superior to all other photographic slides, being permanent pigment photographs, and printed in transparent colours, every gradation of shadow is brought out on the screen. Their warm tone also contrasts most favourably with the cold photographic colour.

THE SCENOGRAPH.

A very light and portable Tourist's Folding Pocket Camera. By the New Dry Process, Chemicals are left at home, and the Sensitive Plates developed at leisure. No previous knowledge necessary.

No. 1. For Pictures $4\frac{1}{4} \times 3\frac{1}{4}$, with lens stand and can	... ...	35/-
No. 2. For Stereoscopes or Cabinets „	... ...	50/-
No. 3. For Pictures, 7 × 5 „	... ...	50/-

Well adapted for use of Engineers, &c., for taking photographs of machinery or progress of works. Manual of Instruction (with Photo) seven stamps.

SCIOPTICON COMPANY,

157, GREAT PORTLAND STREET, LONDON, W.

PHOTOGRAPHY
(RAPID DRY PROCESS).

Previous Knowledge not necessary.

No Chemicals required in the field, Tourists' Pocket Camera and Slides, for Plates 4¼ by 3¼. Lens, Patent Folding Stand, Chemical Laboratory, and every requisite.

Price Complete, £8 8s.

THE SAME SET FOR PICTURES 5 × 4, £9 9s.

Practical Instruction Free.

Sensitive Plates 2s. 6d. per doz.

WRATTEN & WAINWRIGHT,
38, GREAT QUEEN ST., LONG ACRE, W.C.

W. T. HENLEY,
TELEGRAPH ENGINEER AND CONTRACTOR.

MANUFACTURER OF SUBMARINE CABLES.

Wire and all Telegraphic Stores, also Galvanised and Corrugated Iron Sheets.

8, Draper's Gardens, Throgmorton Street, London.
WORKS—NORTH WOOLWICH.

M. THEILER & SONS,
TELEGRAPH INSTRUMENT MANUFACTURERS,
86, *CANONBURY ROAD, LONDON, N.*
MANUFACTORY—ALWYNE LANE, N.

Specialties:—Patent Polarized Relays for Cables and Land-lines, Morse Instruments, Vibrating Sounders, Speed Recorders.

SOLE MAKERS OF THEILER'S NEW RECORDING SOUNDER AND TYPE PRINTER.

Contractors for Duplexing Land-lines (Morse, Sounder or Hughes Circuits) by THEILER'S PATENT MECHANICAL DUPLEX—WITHOUT Artificial Line.

PETER BROTHERHOOD,
ENGINEER,
56 & 53, COMPTON STREET, GOSWELL ROAD, E.C.

SILVER MEDAL, PARIS EXHIBITION.

PATENT 3-CYLINDER ENGINES
AS USED BY
Siemens, Gramme, and Wilde,
FOR DRIVING
DYNAMO-ELECTRIC MACHINES

THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW.

VOL. VII.—No. 157.

THE RESERVE FUNDS OF THE CABLE COMPANIES.

RECENT occurrences in connection with submarine cable enterprises have had the effect of directing the attention of all thinking men, interested therein, to the future of our submarine cables, and also to the present state of the reserve or renewal funds of the various companies.

It is thought by some of our leading practical electricians, that, in a few years, nearly all existing deep-sea cables will have become useless for telegraphic purposes; and others estimate that the life of these electrical conductors will endure for ten or even twenty years yet. Whatever length of time they may last, and this will vary according to the kind of cable and the ground on which it is laid, it is certain they are at present anything but permanent property. Many hundreds of miles of cable have already become totally useless, and without going much into details we may mention that of the seven cables laid across the Atlantic some are quite defunct, while as we are writing, two are in need of repair, and only two are left to do the whole message traffic from Europe to the United States and the Dominion of Canada.* As a general rule, cables laid in shallow waters are very liable to breakage, but, on the other hand, they are easily repaired. With deep-sea cables, although faults are comparatively unfrequent, the repairing is almost impossible owing to the outer covering and sheathing becoming weakened by decay. Last year an expedition composed of the s.s. *Seine* and s.s. *Calabria* failed to repair the 1866 (Atlantic) cable, and returned to this country on the 27th July, 1878. "The failure was caused by oxidation of the iron wire and decay of the hemp of which the outer covering of the cable consisted." So stated the report of the Anglo-American Telegraph Company.

It may be urged that cables will eventually be made more lasting, or that they may be made much cheaper, so as to permit of total renewals at comparatively frequent intervals, or it may be possible to obtain more sensitive instruments to enable work to be done after faults have shown themselves; but so exquisitely sensitive are the instruments now used that we fancy little can be hoped for in this direction.

Having considered to some slight extent the durability of the cables, the next point which demands notice is that of the reserve or renewal funds of the various companies. Taking the amount of the capitals together of four of the principal companies, having mostly submarine cables rather than land-lines, and the bulk of whose capital is invested in the sea, we find it to reach the considerable sum of over £15,360,000, whilst the reserve funds of the same companies also added together, amount to £731,659.

It cannot be said that directors are to blame for paying excessive dividends; for, with the exception of three companies, two of which pay 6 per cent., and the remaining one 17½ per cent., none of the companies pay over 5 per cent., and two or three pay nothing at all on the ordinary shares.

Nor can it be maintained that the reserve funds are at all adequate to complete renewal, for, doubtless, directors see as well as we do that, unless the receipts increase very remarkably, there is little likelihood of their being able to add any adequate amounts to the reserve funds, and at the same time satisfy their respective shareholders with dividends. The question then arises,—if the traffic returns do not increase, what is to become of those enterprises where no sufficient allowance has been made for renewal? Are they to lapse, or will the Government step in, and, for the sake of retaining our telegraphic communications with the rest of the world, and particularly with our colonies and foreign possessions, subsidize and sustain them, or, purchase existing rights, and, relaying the cables where necessary, work them itself?

The question is one of vast and ever increasing interest, alike to directors, shareholders, electricians, and all engaged in connection with submarine telegraphy—to the whole world, we may say—and the more the directors are aided in their difficult task, by the shareholders, the better will it be for all concerned, and particularly for the shareholders themselves. It would be living on in a Fool's Paradise not to look this serious matter boldly in the face. The Trust companies holding telegraphic securities must also necessarily be affected by whatever affects the success of those companies whose securities they possess.

BRIGHT'S TYPE-PRINTING TELEGRAPH.

THE principle upon which this apparatus, the invention of Sir C. T. Bright, is worked, is decidedly novel: it is briefly that of causing the letters to be printed by inserting different artificial resistances into the line circuit at the sending station.

Fig. 1 shows the transmitting apparatus at the sending station. It consists of a key-board, the keys of which are of ivory or wood, so as to be insulated from each other, and are marked with the letters of the alphabet. Each of the keys is fixed upon a metallic spring *a*, one end of which is connected to a resistance coil *b*. The other end of each resistance coil is connected to earth. Immediately beneath the keys, and along the entire key-board, there is a metallic bar *c*, *c*, moving on centres *d*, *d*; when at rest it is pressed by a spring against the metallic plate *e*, which is connected to earth. A metallic pin *f*, attached to the under side of the spring of each key, breaks the connection between *c* and *e* when any of the keys is depressed, and contact then being made between *f* and *b*, the resistance coil belonging to the key is placed in the circuit.

---

* Since writing these lines, communication by a third cable has been restored.

FIG. 1.

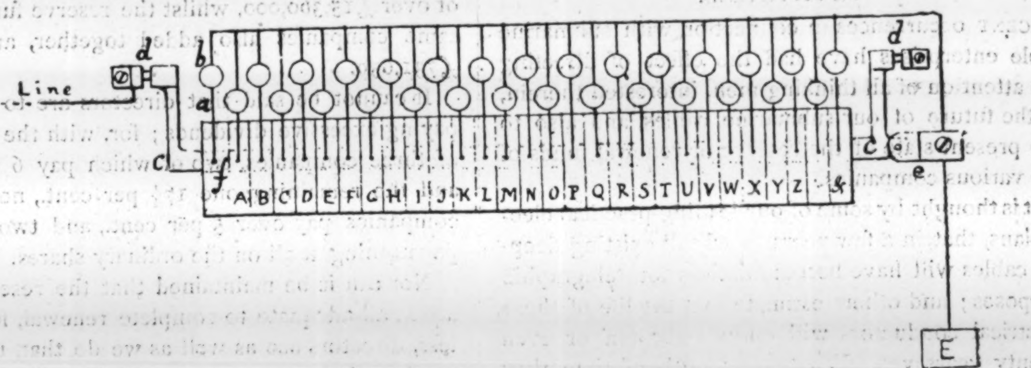


FIG. 2.

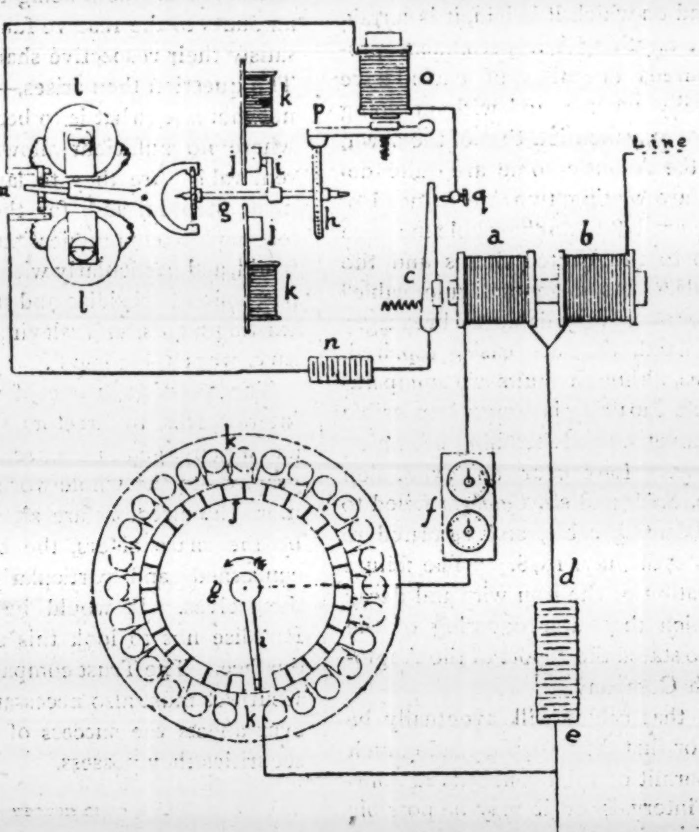


Fig. 2 shows the working parts and connections of the type-printing instrument at the receiving station; *a* and *b* are the coils of a differential relay, and the upper portion of the figure represents a local circuit, made or broken by the armature lever *c*. The lower portion also shows some of the parts comprised in the upper portion, and these are indicated by the same letters. Coil *b* is connected to the line wire, and to the pole *d* of a battery whose other pole *e* is connected to earth. Coil *a* is also connected at one end to *d*, and at the other end to the adjustable rheostat *f*, composed of resistance coils which can be adjusted to equal the resistance of the line circuit, and can be varied to compensate for any change in the latter. The other end of *f* is connected to an axle *g*, *g*, upon which is fixed the type-wheel *h*, and also a metallic arm *i*, *i*, which, when the axle is in motion, passes over and makes contact with a series of metallic plates *j*, *j*, *j*, to which are connected a series of resistance coils *k*, *k*. Two or more type-wheels may be carried by *g*, *g*, so that two or more duplicates of a message may be printed simultaneously. *l*, *l*, is an electro-magnet, and *m* its commutator; *n* is a local battery by which *l*, *l*, is worked, and the axle *g*, *g*, rotated thereby when the local circuit is closed by the action of *c*. A train of clockwork may be controlled by *l*, *l*, in place of directly propelling *g*, *g*; *o* is an electro-magnet acting upon the printing pad *p*. When the instrument is not at work, *c* is in the position shown in the figure, but, upon a resistance being inserted at the sending station, the local circuit is completed by the motion of *c* against the stop *q*, and *g*, *h*, and *i* rotate until *i* comes into contact with the particular plate *j*, by which the amount of resistance inserted at the sending station is equalled, whereupon the current passing through *a* and *b* being balanced, *c* is separated from *q*, the movement of the type-wheel ceases, and the paper is impressed against *h* by *p*.

NEW TELEPHONE CALLS.

M. PERRODON, a French captain of artillery, has invented a system of telephonic alarm which furnishes very good results in its application to military service, and which has for its exciting organ a sort of electro-magnetic trembler constituted by the telephone itself. It is an improvement of the system of MM. Dutertre and Gonault suggested a considerable time ago; and it is greatly owing to the ingenious arrangements of M. Trouvé the constructor of the apparatus, that its success is so marked.

Fig. 1 represents a section of the instrument, with the mouthpiece removed in order the better to display the mechanism. The mouthpiece is shown above the rest of the illustration. The magnetised bar of the telephone is shown at B, the bobbin at C, and the alarm arrangement at K. This arrangement is worked by a hand lever E, pivoted horizontally, and carrying at F and G perpendicular projections or contact cams. When the instrument is set for speaking, as indicated by the position of the handle *a*, which is then directed towards the letter T, inscribed on the case of the telephone, the cam G presses a spring H, fixed on the bottom of the box of the telephone and which communicates with the wire of the bobbin C. When, on the contrary, the instrument is arranged to give an alarm, a condition in which the handle is turned in the reverse direction to that in which it was during speaking, it is the cam F which comes into contact with a little claw connected to the spring-lever K fixed to L and raises it. This lever raised at K touches with its platinum point the centre of the diaphragm of the telephone at a small platinum contact-stud fixed to it; and forms with the latter a trembling circuit interrupter. The connections are joined up in such a way, that when contact has been established between the diaphragm and the spring in question, the current from a local battery traverses the bobbin of the telephone in such a manner as to produce an enfeeblement of the magnetisation of the magnetic core, and the result is a withdrawal of the diaphragm, which thereupon breaks contact with the spring, and, consequently, the magnet recovering its strength again draws the diaphragm into a new contact with the spring, which in turn determines a new break.

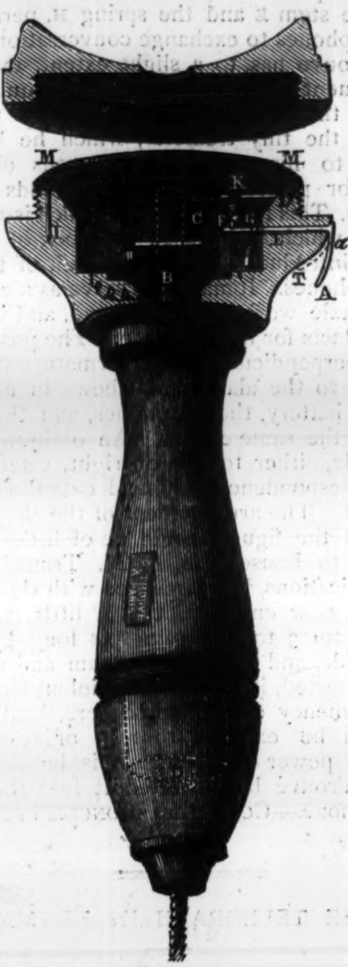


FIG 1.

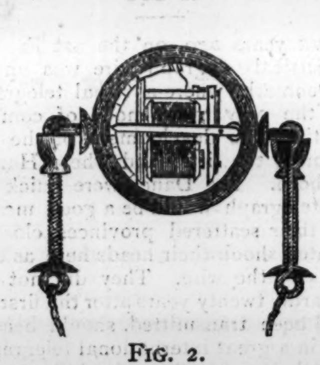


FIG. 2.

There is thus produced a decided vibratory movement which transmits successive jets of current through the line, sufficiently powerful to cause the diaphragm of the receiving telephone to emit sounds capable of furnishing a serviceable call-signal.

This effect only takes place, it must be remembered, when the handle *a* is turned towards the letter A. When turned in the opposite direction, the local battery is withdrawn from the circuit, and the line is put directly in connection with the bobbin B, by the stem E and the spring H, permitting the two telephones to exchange conversation directly.

M. Trouvé has, to a slight extent, modified this arrangement by making the trembler quite independent of the telephone; and for this purpose he employs the tiny trembler, which he has already applied to his exploring apparatus designed to search for projectiles sunk in wounds caused by fire-arms. This little apparatus, which is represented in fig. 2, which is enclosed in a box of clear thick glass, is introduced into the circuit of the battery and telephones. It may even serve as a commutator for the axle worked by the hand, and is furnished with contacts for that purpose. The position of the handle perpendicular to the armature (fig. 1), corresponds to the alarm, and shews in consequence that the battery, the telephones, and the trembler, are all in the same circuit. An oblique position of the handle, either to left or right, establishes telepone correspondence only, and cuts the battery out of circuit. The arrangement of the alarm trembler shewn in the figure would be of little use to the army or to households, so M. Trouvé, for these new applications, has dispensed with the small glass box, and now encloses it in a little case of hard rubber from 3 to 4 centimetres long by 1½ centimetre wide, and completely steam and water-tight. Thus protected, it can sustain violent shocks, suffer the inclemency of the atmosphere, heat, humidity, and even be exposed to rain or snow without losing its power of action. It is, besides, so small that M. Trouvé has inserted it into the handle of the telephone.—COUNT DU MONCEL in *La Lumière Electrique.*

THE TELEGRAPH IN DENMARK.

By CARL HANSEN, Fredericia, Jutland.

TWENTY-FIVE years ago, on the 1st February, 1854, the first electrical telegraph wire was opened to the public in Denmark, where a visual telegraph had for years been the only rapid mode of communication. Since that time the development of the system has been well worthy the little land where Hans Christian Orsted was born. The Danes were quick to see that the electric telegraph would be a good means for connecting all their scattered provinces closer together. The uninitiated shook their heads here as elsewhere at the prospects of the wire. They did not dream that Denmark, hardly twenty years after the first telegraphic message had been transmitted, should become an important link in a great international telegraph system.

On the 17th March, 1852, the bill concerning the erection of an electro-magnetic telegraph in Denmark was issued; but although Sweden only commenced to consider the subject a year later than Denmark, she opened her first telegraph wire between Stockholm and Upsala on the 1st August, 1853, whereas Denmark only opened hers on the 1st February, 1854. The Danish line was, however, of a considerably greater length than the Swedish one. Some difficulty arose from the choice to whom the work should be given; but at last it was resolved that one of the officers of the Royal Engineers should direct the whole work. The line was an underground one, with cables over the "belts" or straits which separate the different provinces from each other. It was no easy task to begin on account of the slender experience which had been gained of the whole matter, and especially of submarine cables, for only one had as yet been laid, viz., between Dover and Calais.

The wire was successfully laid down through Seeland, Fione, and a part of Jutland, when fault of insulation compelled them to take it up again. They had also to fight with the public ignorance of electricity; and the difficulties that arose from this fact were not slight. It was found, for instance, necessary to get a bill to protect the new buildings, and to fix a penalty for its destruction. This bill was issued on the 29th December, 1853, and four weeks after, the line, which had been finished at Christmas, 1853, was opened to the public. The joy caused by this event was nevertheless very short lived, for the very day it was opened it broke down again. Luckily the fault proved to have been caused by a slip of earth in the neighbourhood of Aabenraa, in Schlesvig, and the fault soon repaired.

In 1855, Denmark was in direct cable communication with Sweden and Norway, and the international traffic of these two countries was thus directed through Denmark, which then commenced to play the part with regard to international telegraphy, which her situation seems to have fitted her for. The new traffic carried, however, new obligations for her, obligations which Denmark has never hesitated to bear, as she is well aware of the great benefit proceeding from a great transit traffic through her territory.

The underground system proved itself more and more a failure, for even if it was sometimes possible to transmit thirty telegrams an hour, yet this achievement was rare, and the leading men, of whom the deceased director Faber was the head, laid new and better plans for a complete alteration of the system. Their object was to build an aërial line 628 miles long, with a length of wire of 1,700 miles, and 24 offices, in the year 1856, and the new line was really finished in time and opened on the 1st January, 1857. With the over-head line they had also to encounter many difficulties caused by the stormy climate, so that very often only one wire could be employed. The poles rotted, and fell in great number every time it blew a gale, the insulation was very defective, and the rusty wires broke down; and, when the year 1860 arrived, they were almost as bad with the aërial as before with the underground.

The successful laying of the direct Danish-English cable in 1860, with Flensborg and London as terminal points, by which more traffic passed across the country, gave new courage and strength to the leading men, who saw the necessity of introducing improvements, since the countries which charged us with their telegrams had a right to request that frequent disturbances and delays should not interrupt the communication.

The result of all this was the present system with impregnated poles, meant to stand some twenty or twenty-five years; porcelain insulators of a new construction, the screw of which was invented by a Danish labourer; and galvanised iron wire. Both the poles and insulators are manufactured in Denmark. The poles themselves are cut in the great woods, near Soró, Seeland, where they are treated after Boucherie's method, in an establishment founded in 1861, whence more than 50,000 poles have now been sent out. The Danish porcelain manufactories have finished about 200,000 insulators for home use, besides many thousands more during the earlier years to Sweden and Norway. The new aërial telegraph system, which is completed over the whole country, has proved very satisfactory. It was finished in the year 1863 after much labour and toil. Everywhere the eye meets the silent wires through which news are carried to the most retired part of the country.

At one of the Telegraph Conferences at Paris, the Prussian Director of Telegraphs affirmed that he had nowhere found such a beautiful telegraph system as in Denmark.

The following figures will illustrate the activity of the Danish telegraph system, from its beginning in 1854 till 1877:

	1854.	1863.	1865.	1877.
Stations	9	83	68	246
Instruments	14	134	104	266
Staff	25	144	119	372
Telegrams	20,043	222,653	193,956	982,274
			Miles.	Kilos.
Length	284·00	1118·00	828·28	3·224
of line	457·00	1798·862	1332·693	
Length	308·00	2903·2	1877·28	8·937
of wire	495·57	5271·2	3020·544	

Of the stations 121 are government offices, 121 are railway stations, and four are semaphore posts. The reduced figures in 1865 are caused by the loss of the two Duchies Schleswig, and Holstein.

In the war with Germany and Austria in 1864, the telegraph was busily engaged in a difficult undertaking for the first time, viz., to maintain the connection between the different parts of the army; and everybody agreed that it solved the problem in a very satisfactory manner. War stations were erected everywhere with the army, from the beginning of the war till its end. They kept their posts to the last at Dannevirke, at Als, and at Fredericia, during the retreat of the army through Jutland, and maintained communication until the very moment when the enemy occupied them. A special telegraph service has now been established in the Engineers' corps of the army, in which the telegraphist conscripts work off their service, and are made under-commanders, so that the army has always a staff of practical telegraph clerks at her disposal. The war which reduced our frontier so considerably, extended the telegraph system on a great scale. New wires were put up and many new stations erected in all towns and larger villages. Along the railways of Fyen and Jutland is a special wire set apart for public traffic. On points that are of importance to navigation there are semaphore stations which receive communications from passing ships and transmit them by telegraph to ship owners; and every day the meteorological office at Copenhagen receives reports from numerous posts of observation all over the country, and sends the results abroad.

Ship-owners and everybody to whom it may be of any use can receive daily, for a moderate payment, reports from the meteorological institute. Why the internal telegraph traffic in Denmark may possibly seem somewhat small compared with other countries, such as Sweden and Norway, is not very difficult to understand. In these two countries the towns are far from each other, and the post is unable to satisfy the requirement of speed, while this is more easily fulfilled in Denmark, where railways and good roads connect all the chief points with each other, and the post is able to carry letters in cases where the telegraph under other circumstances would have been employed.

In the early days of the telegraph, the payment for a telegram was rather dear, 2s. 2d. for twenty-five words; but time has altered this too, and every time the tax has been reduced, the number of telegrams has shown that the reduction had not lessened the income of the telegraph. In 1860, it was reduced to 1s. 5d. for twenty words, 1866 to 9d., and at last, in 1874, to 7½d. The following figures illustrate the different reductions, and speak for themselves:

	1865.	1875.	1877.
Home telegrams	88,634	385,282	428,739

Denmark employs ladies in the telegraph, but only at the smaller offices. The staff is recruited from all classes of society, but operators must prove, either by testimonials, that their learning taught at school answers to the requirements put upon it, or pass an examination, held every year at Copenhagen and Fredericia. It is a knowledge of foreign languages especially that is needed. English, French, and German must be written faultlessly to dictation. Of course the native tongue is not forgotten, nor is a certain amount of technical knowledge. It is generally young men from fourteen to eighteen years of age, that are practically trained at the different stations. The mode of training clerks proves a very good one, for it is seldom that one finds a clerk who is not able to fulfil his duty in a satisfactory manner, especially among the younger ones. The Danish telegraphists may also be said to be very much esteemed abroad as clever and trustworthy operators. Not only the Great Northern Telegraph Company is served by Danish telegraphists, but Russia too has placed many of them at her Siberian stations at very high salaries, to say nothing about the fact that the Danes were the first who brought the telegraph to the people of the farthest East.

The beginner commences with a salary of 400 crowns (about £25) a year, which is gradually raised. The salaries for the telegraph staff are fixed by the Rigsdag, and the bill is revised every fifth year. The salary of the director is 4,000 crowns (about £225) rising to 5,200 crowns (about £300). The superintendent of Copenhagen 3,800 crowns (about £215); the superintendent of Fredericia 3,000 crowns (about £170); the managers of the more important offices 2,400 crowns (about £140); the two head engineers 2,600 crowns (about £150); head clerks and managers of smaller stations, 2,000 and 1,800 crowns (about £115 and £100). The telegraphists are divided into 5 classes, with salaries from 1,600 to 800 crowns (£90 to £45). All salaries are raised by 100 crowns (about £6), every fifth year until 400 crowns (£25). From an English point of view, these salaries may seem rather small, but from a Danish one, they may, on the whole, be said to be pretty good, much better than they were some years ago; and they are expected to be raised a little more still.

The director and the superintendent of Copenhagen are the only members of the whole staff nominated by the king, and they have a right to pensions; while all the others are nominated by the home ministry. From the salaries of these latter 5 per cent. is taken every year to form a superannuation fund. The state does not do anything yet in this regard, but perhaps time will alter this too, for the telegraph is yet a child compared with other government institutions, and when childhood is passed it is hoped that a better mode of taking care of old *employés* will be adopted. The stations, many of which are given to the charge of post-masters, are open from 7 in the morning till 9 in the evening (Copenhagen and Fredericia being the only two offices that are never closed).

This arrangement will probably be altered too, for the Rigsdag has asked the minister to propose a shorter time of duty on Sundays and holidays for the Post and Telegraph. Even if an eventual proposal should be agreed upon I think it will only be applicable to the smaller stations, which are of little importance in international telegraphy. For the others, I think it would be better to extend the time of duty, say till twelve at night. The clerks are on duty seven hours at a time, so that he who has duty in the forenoon is free from duty in the afternoon from two o'clock and *vice versâ*. At Copenhagen and Fredericia where they have night-duty to perform too, the duty is more arduous, but the time demanded of them is about the same, for night duty gives more liberty and extra duty is generally paid for.

As a comparison between the three Scandinavian countries may be supposed to be of some interest, I add some further statistics for the year 1877.

Messages.

	Denmark.	Norway.	Sweden.
Home telegrams -	428,739	552,946	763,294
To foreign countries -	136,438	128,836	153,510
From ,, ,,	145,647	142,905	158,892
Transit ,, ,,	246,632	3,400	82,379
Meteorological and other service messages -	24,818	48,000	17,768
Total for the year -	982,274	876,087	1,175,843

These figures show that Denmark in proportion to her extent and size is not left behind by the two other countries and that her transit traffic is much greater than that of the others.

Stations.

	Denmark.	Norway.	Sweden.
Intern traffic -	129	197	315
Home traffic only	117	197	361.
Of these are:—			
Government offices	121	127	175
Railway ,,	121	69	501
Semaphore ,,	4	1	—

Lines.

	Denmark.	Norway.	Sweden.	
Length of line				
Kilometres -	3,224	8,478	10,740	
Length of wire	8,937	15,108	27,809	kilom.

Staff.

Denmark.	Norway.	Sweden.
563	696	780

THE NEW CABLE STEAMER.

A fine new cable steamer, built to order for Messrs. Siemens Brothers, was launched from the yard of the makers, Messrs. C. Mitchell and Co., Low Walker, Newcastle, on Tuesday, August 5th, in presence of a large number of spectators, including a distinguished company of ladies and gentlemen from France. The vessel is named the *Pouyer-Quertier*, after the well-known French statesman, who occupies the position of Chairman to the New Compagnie Françàis du Telegraphe à New York, in whose service she will be for the future engaged as a repairing ship.

Although much smaller, the new vessel bears in many respects a resemblance to her predecessor, the well-known cable steamer *Faraday*, also built by Messrs. C. Mitchell and Co., for Messrs. Siemens Brothers, about five years ago, and which has gained the reputation of being one of the most successful vessels afloat. Like the *Faraday*, the new steamer has twin screws, is fitted with rudder at each end, and has bilge keels of a special kind. There are on board two principal cable tanks, and sundry small supplementary tanks for coiling and stowing the different descriptions of cable. Her whole form and structure are unusually strong; and although bearing the highest class both of the English Lloyd's and the French Veritas, she is even stronger than required by these societies. The vessel is built with a curved bow, on which will be fitted a projecting girder with a swivel cable sheave, a similar sheave being also fitted at the stern. On the deck will be placed very powerful machinery of the latest and most improved description for "laying" and "picking up" cables. Arrangements will also be made for steering the vessel both by steam and by hand, and throughout she will be fitted with a complete system of telegraphs. This is an appliance indispensable for such a ship, as it enables those in charge to handle her in the promptest possible manner—a consideration of such vital importance in cable-laying. Taking it as a whole, the *Pouyer-Quertier*, embracing all improvements suggested by the extensive experience of Messrs. Siemens Brothers and their staff, may be considered as complete a vessel of the class as it is possible to produce. The machinery consists of a pair of compound surface-condensing engines, manufactured by Messrs. Thomas Clark and Co., of Elswick, including all the latest improvements in marine engineering, and capable of propelling the vessel at the speed of 10 knots per hour on the most moderate consumption of fuel. The dimensions of the steamer are: Length over all, 260 ft.; beam, 36 ft.; depth, 24 ft. 4 in.; and she will have a burthen of 1,800 tons. As the vessel left the ways, the christening ceremony was gracefully performed by Miss Siemens, daughter of Mr. Carl Siemens, who himself was present as the representative of his firm.

THE RISE OF THE THERMO-PILE.

(*Continued from page 249.*)

Bunsen, Markus, and Stefan, in 1865, constructed piles of various alloys, but the first really practical thermo-pile appears to have been that which Mr. Farmer, of America, exhibited in the Exposition of 1867. Mr. Farmer employed German silver and an alloy of copper, zinc, and nickel. This pile lost power rapidly, owing to increase of internal resistance, and the bars frequently broke in cooling.

In 1866, three patents were taken out by Lieut.-Col. James Baker, for various forms and improvements of thermo-piles. Baker was the first to employ the "Stellar" form of pairs, and he arranged them round a cylindrical or polygonal stove, with protecting cylinders of thermo-insulating material. This form is the one now most commonly employed. Baker also made a pile with bars of *one* thermo-electric metal, connected by copper wires.

In 1868, Mr. L. Mure and M. Clamond patented a pile of iron and galena pairs; and, in 1874, M. Clamond obtained letters patent for an improved form of this pile, a detailed account of which we give.

Three patents were taken out in 1872-5, by M. Faure, but are not sufficiently practical or interesting for description. In the latter year, Mr. C. J. Wollaston patented a pile composed of strips of tinned iron and German silver, the strips being set in a perforated fire-tile, and the hot junctions either enamelled or bedded in a non-conducting composition. The heat was supplied by gas, and a gas-regulator, controlled either by clockwork or by a peculiar form of galvanometer-needle was used to adjust the supply. Mr. Wollaston also proposed to employ water-cups to cool the outer junctions.

M. Clamond's battery consists of tinned sheet-iron for the positive elements, and an alloy of two parts of antimony with one of zinc for the negative.

The alloy, which melts at 800° F., is cast into bars from 2 to $2\frac{3}{4}$ inches in length, and from $\frac{3}{8}$ths to 1 inch in thickness. The shape and disposition of the elements are shown in fig. 2. Every 20 of these pairs give an electro-motive force of about 1 volt., and are, therefore, nearly equal to one Daniell cell.

The heat is usually supplied by gas, as in fig. 3, or by coke, as in fig. 4; but, in a recent modification, M. Clamond employs a "collector," composed of pieces of cast-iron, among which hot air circulates: a large surface is thus exposed to heat, the iron communicating the heat to the couples.

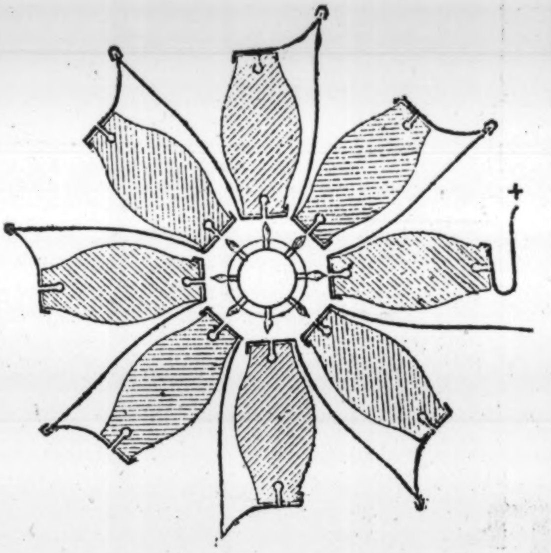


FIG 2.

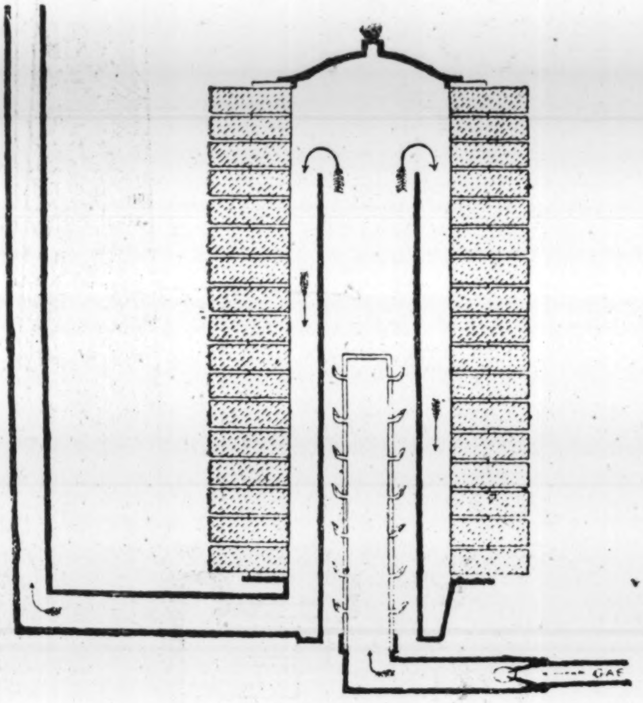


FIG. 3.

M. Clamond's latest achievement is the production of the electric light by means of his thermo-electric battery. For this purpose he has constructed a pile of 6,000 small couples, and with it he produces two powerful lights (or four lights of half the brilliancy). The E. M. F. of this battery is said to be 218 volts., and the resistance 31 ohms. Coke is used as the heat source, the consumption being 10 kilogrammes per hour. A small pile of the same number of pairs, and said to be of equal power, consumes only $6\frac{1}{2}$ kilogrammes per hour.

If a thermo-pile be short-circuited, its effectiveness is reduced, the powerful current flowing through it tending to heat the cool junctions and cool the hot ones. In an elaborate and exhaustive paper upon M. Clamond's battery, read by Mr. Latimer Clark before the Society of Telegraph Engineers in 1876 (to which we are indebted for many of the above facts, as also for the illustrations), it was shown that a battery, short-circuited by a resistance equal to its own, had its E.M.F. rapidly reduced by 2·2 per cent. The pile may, conversely, be "polarised," by passing a powerful current through it, the effect being to heat one series of junctions and cool the alternate ones, thus leaving the pile in a condition to give out a sensible current. This follows from what has already been said respecting Sir William Thomson's and M. Peltier's investigations.

One of the chief applications of the thermo-pile is the deposition of metals. Mr. Clark states that in practice it was found that a battery of 375 pairs, having a resistance of 4·5 ohms., and a tension of 14·6 volts., deposited about 180 grains of copper per hour. He also points out, however, that these figures do not represent the effectiveness of the battery, as a similar deposition could have been produced in several successive cells.

In 1876 and 1877, Messrs. C. and L. Wray obtained patents for improvements in thermo-piles. These improvements may be summed up as follows. The bars (alloy of antimony, zinc, and iron) are cast under pressure: this increases the E. M. F. A strip of tinned iron is cast in them, extending nearly through their entire length: this adds materially to their strength, and to some extent increases the E. M. F., and decreases the resistance. The successive layers of couples are supported by a metal framework, the weight of the upper layers being thus prevented from falling upon the lower ones. An internal cylinder of earthenware is employed to keep the flame from infringing directly upon the bars, and also to cause the bars to cool more slowly, fractures being thus avoided. The supply of gas and air is regulated, and a wire-gauze chimney is used to prevent explosions.

M. Noë and M. Sudré have intoduced important should be agreed upon I think it will only be applicable to the smaller stations, which are of little importance in international telegraphy. For the others, I think it would be better to extend the time of duty, say till twelve at night. The clerks are on duty seven hours at a time, so that he who has duty in the forenoon is free from duty in the afternoon from two o'clock and *vice versâ*. At Copenhagen and Fredericia where they have night-duty to perform too, the duty is more arduous, but the time demanded of them is about the same, for night duty gives more liberty and extra duty is generally paid for.

As a comparison between the three Scandinavian countries may be supposed to be of some interest, I add some further statistics for the year 1877.

MESSAGES.

	Denmark.	Norway.	Sweden.
Home telegrams -	428,739	552,946	763,294
To foreign countries -	136,438	128,836	153,510
From „ „	145,647	142,905	158,892
Transit „ „	246,632	3,400	82,379
Meteorological and other service messages -	24,818	48,000	17,768
Total for the year -	982,274	876,087	1,175,843

These figures show that Denmark in proportion to her extent and size is not left behind by the two other countries and that her transit traffic is much greater than that of the others.

STATIONS.

	Denmark.	Norway.	Sweden.
Intern traffic -	129	197	315
Home traffic only	117	197	361.
Of these are :—			
Government offices	121	127	175
Railway „	121	69	501
Semaphore „	4	1	—

LINES.

	Denmark.	Norway.	Sweden.	
Length of line				
Kilometres -	3,224	8,478	10,740	
Length of wire	8,937	15,108	27,809	kilom.

STAFF.

Denmark.	Norway.	Sweden.
563	696	780

THE NEW CABLE STEAMER.

A FINE new cable steamer, built to order for Messrs. Siemens Brothers, was launched from the yard of the makers, Messrs. C. Mitchell and Co., Low Walker, Newcastle, on Tuesday, August 5th, in presence of a large number of spectators, including a distinguished company of ladies and gentlemen from France. The vessel is named the *Pouyer-Quertier*, after the well-known French statesman, who occupies the position of Chairman to the New Compagnie Français du Telegraphe à New York, in whose service she will be for the future engaged as a repairing ship.

Although much smaller, the new vessel bears in many respects a resemblance to her predecessor, the well-known cable steamer *Faraday*, also built by Messrs. C. Mitchell and Co., for Messrs. Siemens Brothers, about five years ago, and which has gained the reputation of being one of the most successful vessels afloat. Like the *Faraday*, the new steamer has twin screws, is fitted with rudder at each end, and has bilge keels of a special kind. There are on board two principal cable tanks, and sundry small supplementary tanks for coiling and stowing the different descriptions of cable. Her whole form and structure are unusually strong; and although bearing the highest class both of the English Lloyd's and the French Veritas, she is even stronger than required by these societies. The vessel is built with a curved bow, on which will be fitted a projecting girder with a swivel cable sheave, a similar sheave being also fitted at the stern. On the deck will be placed very powerful machinery of the latest and most improved description for "laying" and "picking up" cables. Arrangements will also be made for steering the vessel both by steam and by hand, and throughout she will be fitted with a complete system of telegraphs. This is an appliance indispensable for such a ship, as it enables those in charge to handle her in the promptest possible manner—a consideration of such vital importance in cable-laying. Taking it as a whole, the *Pouyer-Quertier*, embracing all improvements suggested by the extensive experience of Messrs. Siemens Brothers and their staff, may be considered as complete a vessel of the class as it is possible to produce. The machinery consists of a pair of compound surface-condensing engines, manufactured by Messrs. Thomas Clark and Co., of Elswick, including all the latest improvements in marine engineering, and capable of propelling the vessel at the speed of 10 knots per hour on the most moderate consumption of fuel. The dimensions of the steamer are: Length over all, 260 ft.; beam, 36 ft.; depth, 24 ft. 4 in.; and she will have a burthen of 1,800 tons. As the vessel left the ways, the christening ceremony was gracefully performed by Miss Siemens, daughter of Mr. Carl Siemens, who himself was present as the representative of his firm.

THE RISE OF THE THERMO-PILE.

(*Continued from page* 249.)

BUNSEN, MARKUS, AND STEFAN, in 1865, constructed piles of various alloys, but the first really practical thermo-pile appears to have been that which Mr. Farmer, of America, exhibited in the Exposition of 1867. Mr. Farmer employed German silver and an alloy of copper, zinc, and nickel. This pile lost power rapidly, owing to increase of internal resistance, and the bars frequently broke in cooling.

In 1866, three patents were taken out by Lieut.-Col. James Baker, for various forms and improvements of thermo-piles. Baker was the first to employ the "Stellar" form of pairs, and he arranged them round a cylindrical or polygonal stove, with protecting cylinders of thermo-insulating material. This form is the one now most commonly employed. Baker also made a pile with bars of *one* thermo-electric metal, connected by copper wires.

In 1868, Mr. L. Mure and M. Clamond patented a pile of iron and galena pairs; and, in 1874, M. Clamond obtained letters patent for an improved form of this pile, a detailed account of which we give.

Three patents were taken out in 1872-5, by M. Faure, but are not sufficiently practical or interesting for description. In the latter year, Mr. C. J. Wollaston patented a pile composed of strips of tinned iron and German silver, the strips being set in a perforated fire-tile, and the hot junctions either enamelled or bedded in a non-conducting composition. The heat was supplied by gas, and a gas-regulator, controlled either by clockwork or by a peculiar form of galvanometer-needle was used to adjust the supply. Mr. Wollaston also proposed to employ water-cups to cool the outer junctions.

M. Clamond's battery consists of tinned sheet-iron for the positive elements, and an alloy of two parts of antimony with one of zinc for the negative.

The alloy, which melts at 800° F., is cast into bars from 2 to $2\frac{3}{4}$ inches in length, and from $\frac{3}{8}$ths to 1 inch in thickness. The shape and disposition of the elements are shown in fig. 2. Every 20 of these pairs give an electro-motive force of about 1 volt., and are, therefore, nearly equal to one Daniell cell.

The heat is usually supplied by gas, as in fig. 3, or by coke, as in fig. 4; but, in a recent modification, M. Clamond employs a "collector," composed of pieces of cast-iron, among which hot air circulates: a large surface is thus exposed to heat, the iron communicating the heat to the couples.

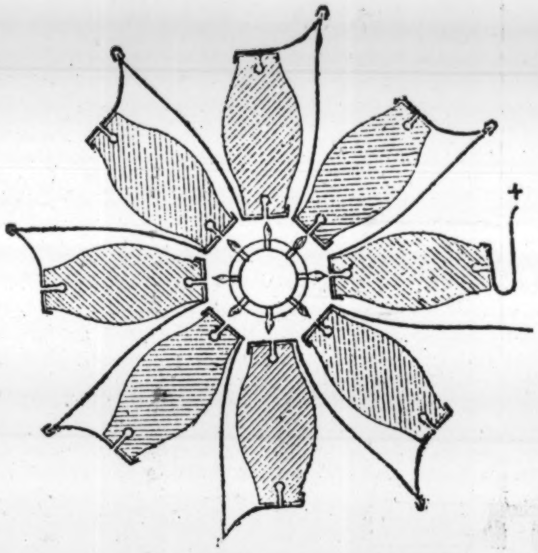


FIG 2.

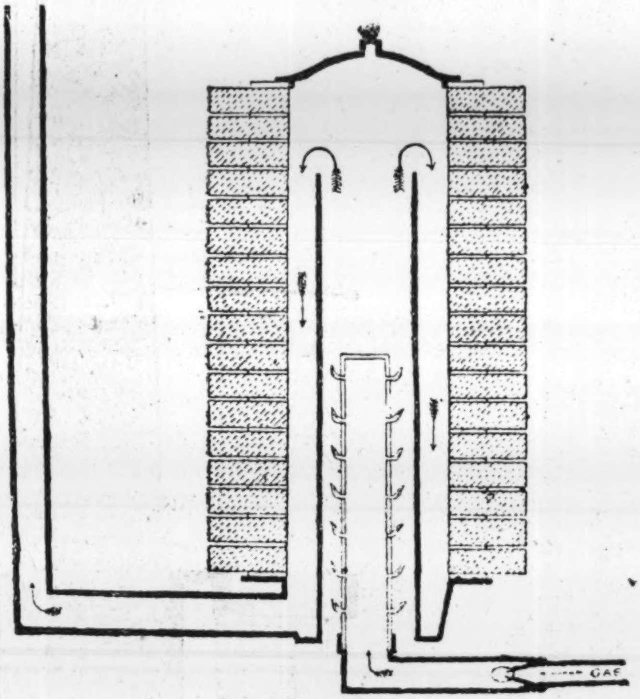


FIG. 3.

M. Clamond's latest achievement is the production of the electric light by means of his thermo-electric battery. For this purpose he has constructed a pile of 6,000 small couples, and with it he produces two powerful lights (or four lights of half the brilliancy). The E. M. F. of this battery is said to be 218 volts., and the resistance 31 ohms. Coke is used as the heat source, the consumption being 10 kilogrammes per hour. A small pile of the same number of pairs, and said to be of equal power, consumes only $6\frac{1}{2}$ kilogrammes per hour.

If a thermo-pile be short-circuited, its effectiveness is reduced, the powerful current flowing through it tending to heat the cool junctions and cool the hot ones. In an elaborate and exhaustive paper upon M. Clamond's battery, read by Mr. Latimer Clark before the Society of Telegraph Engineers in 1876 (to which we are indebted for many of the above facts, as also for the illustrations), it was shown that a battery, short-circuited by a resistance equal to its own, had its E.M.F. rapidly reduced by 2·2 per cent. The pile may, conversely, be "polarised," by passing a powerful current through it, the effect being to heat one series of junctions and cool the alternate ones, thus leaving the pile in a condition to give out a sensible current. This follows from what has already been said respecting Sir William Thomson's and M. Peltier's investigations.

One of the chief applications of the thermo-pile is the deposition of metals. Mr. Clark states that in practice it was found that a battery of 375 pairs, having a resistance of 4·5 ohms., and a tension of 14·6 volts., deposited about 180 grains of copper per hour. He also points out, however, that these figures do not represent the effectiveness of the battery, as a similar deposition could have been produced in several successive cells.

In 1876 and 1877, Messrs. C. and L. Wray obtained patents for improvements in thermo-piles. These improvements may be summed up as follows. The bars (alloy of antimony, zinc, and iron) are cast under pressure: this increases the E. M. F. A strip of tinned iron is cast in them, extending nearly through their entire length: this adds materially to their strength, and to some extent increases the E. M. F., and decreases the resistance. The successive layers of couples are supported by a metal framework, the weight of the upper layers being thus prevented from falling upon the lower ones. An internal cylinder of earthenware is employed to keep the flame from infringing directly upon the bars, and also to cause the bars to cool more slowly, fractures being thus avoided. The supply of gas and air is regulated, and a wire-gauze chimney is used to prevent explosions.

M. Noë and M. Sudré have intoduced important modifications of the thermo-pile; but as these have been fully described in this Journal (June 15 and July 1, 1879), we need not refer to them here.

The following are some of the principal points to be observed in the construction of the thermo-electric battery:—

1. The materials should not be costly.
2. They should not be liable to fuse.
3. They should be protected from sudden heating and cooling.
4. They should not be acted upon by the products of combustion; or they should, at any rate, be protected therefrom, and from the deposition of moisture.
5. The disposition should be such as to allow a defective pair to be easily replaced.
6. The whole combination should possess strength and solidity.

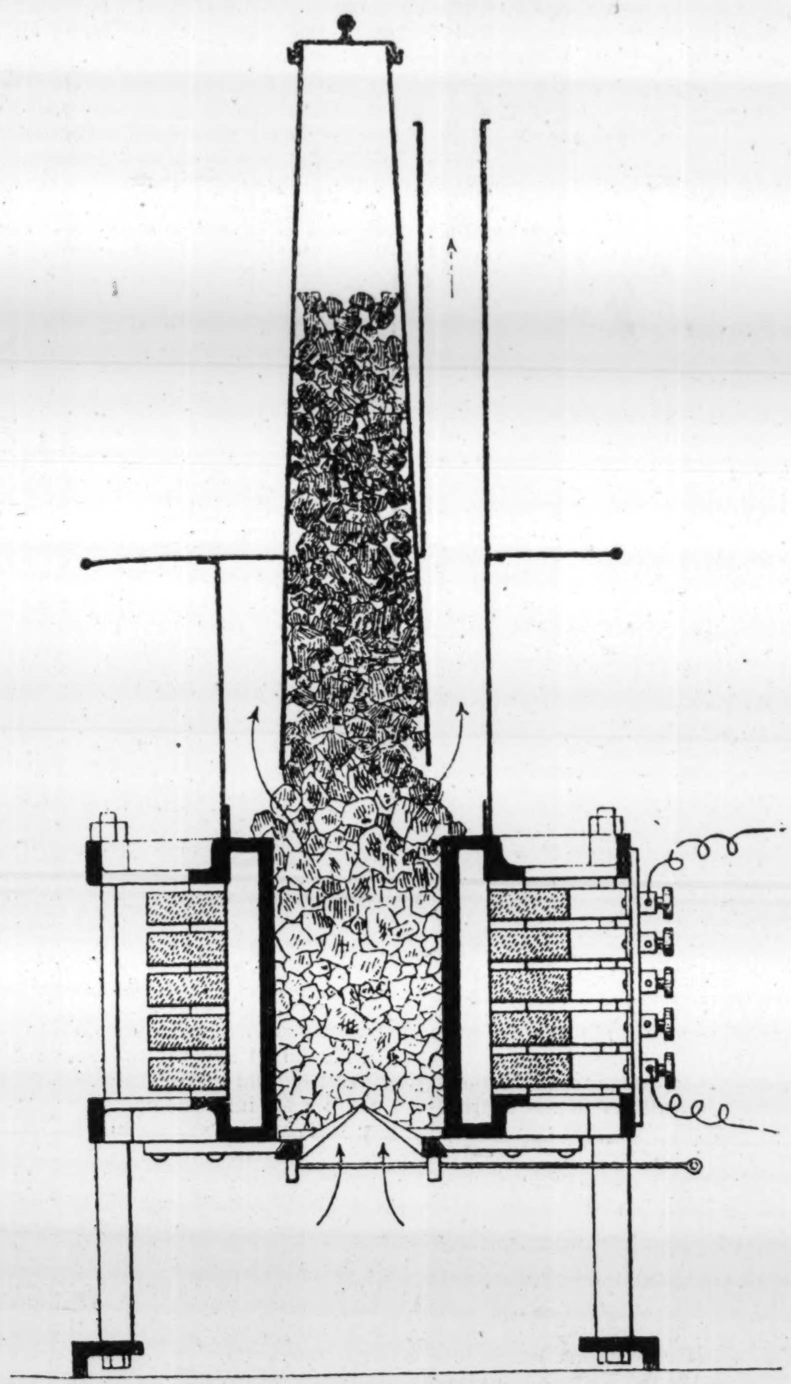


FIG. 4.

The present article is written in the hope that our countrymen will take up the subject and show that this branch of electrical science has not been abandoned to continental inventors.

Correspondence.

[We do not hold ourselves responsible for the opinions of our correspondents.]

To the Editor of THE TELEGRAPHIC JOURNAL.

SIR,—In your Journal of the 15th April, 1877, a simple and novel system of Duplex working, by J. J. Fahie, is described. Of the many advantages which this system is supposed to possess over other existing systems, as claimed by Mr. Fahie, is a very important one, and that is, that "*no condensers*" are at all required to balance the electro-static capacity of a line. This statement is supported by the results of actual trials on some of the telegraph lines in Persia.

To test the utility of the system, some careful experiments *without condensers* were made on the Indian lines. The results were, as anticipated, utter failures.

The failure was due to the fact that the electro-static capacity of the lines could not be balanced by the batteries as described by Mr. Fahie.

If you, or any of the practical electricians are of opinion that "*condensers*" are *actually not* required in the system, I shall deem it a great favour if an accurate explanation of the *theory* be inserted in the columns of your Journal.

You would also oblige me very much by letting me know the electro-static capacity of the condensers (in microfarads) employed by Edison in the *non-polarised relay circuit* of his Quadruplex system.

Also, I shall feel much obliged if you, or anybody else, will kindly inform me, through the medium of your Journal, on the utility of "Double Current" working, as applied to ordinary circuits, that is to say:—

1. Does "Double Current" working *actually* increase speed and the distance to be worked by eliminating the retardation due to the electro-static capacity of the line; and
2. Does the *negative* current employed in the system *actually lower* the insulation of the line? If the latter be correct,
3. What effect has it on the Quadruplex systems used largely in England, America, and other countries worked on the "Double Current" principle?

Yours truly,

"INDIAN TELEGRAPH."

[*No* duplex system, as far as we are aware, has yet been invented which has enabled condensers to be dispensed with when the apparatus comes to be worked on long circuits. In certain cases, it is true, owing to the mechanical construction of the apparatus the effects of the inductive discharge have been less felt, but they have not been neutralised, strictly speaking, but have only been *disguised*, and when a crucial test has been made, such as you have described, the result has proved that the effect anticipated has not been obtained, and a *correct* examination of the theory of the invention would have proved that the inventor's theory is false. Let all the different duplex systems invented be tried under exactly the same conditions, and we believe the effect of the inductive discharge will be found to be the same in all. Condensers, or equivalents to condensers, such as electro-magnetic shunts are, we believe, necessary in any case on long lines if duplex working is to be efficiently and economically (as regards battery power) carried on.

The non-polarised relay has been superseded, and with great advantage, by Gerritt Smith's compound relay. When the former apparatus was employed, the condenser used to "bridge over;" the kick of the armature varied according to the length of the line; about 1½ microfarads may be taken as the average capacity required.

As regards "Double Current" working on ordinary circuits, the employment of the system does not increase the working speed by diminishing the inductive embarrassment, and even if it did diminish the latter the highest rate at which signals could be sent on any land line, even when retarded, would be much beyond what it would be possible to send by hand or at "key" speed. Double current working is used, not to obtain increased speed but to enable signals to be sent at all under the varying conditions of a long line. In the single current system if the line current varies to any great extent, a constant adjustment of the instrument and armature spring is necessary in order to obtain good signals, or, indeed, to obtain signals at all. With the double current system where polarised relays are employed, the tongue of the latter is set nearly neutral and being equally affected by the "marking" and "spacing" currents, works equally well whether these currents are strong or weak, that is, of course, within certain limits. Also, there being no spring for the current to work against, a very weak current will give good signals.

The negative currents employed in the system do not lower the insulation of the lines, they have no effect whatever on them.]

MORGAN BROWN *v.* JACKSON.

SIR,—Some time ago you mentioned in your journal that the action Morgan Brown *v.* Jackson was to be tried before V.-C. Bacon with witnesses. As these witnesses, it was reported, were to be Sir Wm. Thomson and the like, I looked forward to the trial with great interest, but could never discover that the matter has come to trial. Mr. Jackson's advertisements of a telephone are still to be seen in your journal, so I am at a loss to know how the matter stands, and I am sure that the public would gladly hear something of the state of things in the coming journal of the 15th.

I am, Sir, your obedient servant,

8th August, 1879. H. YATMAN.

[The case mentioned above has not yet come on for trial, but will probably be among the first on the list after the present vacation.—ED. T. J.]

Notes.

THE TELEGRAPHIC CONGRESS.—The labours of the International Telegraph Conference have at last been brought to a close. The conclusions at which the delegates have arrived have yet to be approved by the various Governments concerned, and will not be acted upon until April, 1880. The Conference has decided that the tariff for messages shall be a word tariff, with the addition of a fixed sum or constant, equal to the charge of five words, for the use of the wires. In Europe the length of a word is fixed at fifteen letters, and beyond Europe at ten letters. Words separated by hyphens or apostrophes are counted separately, but in extra-European messages hyphens may be omitted by the sender, although no other departure from ordinary spelling—no contractions, for example—are admissible. Within the limits of Europe, five figures are counted as one word, and any excess over five or some multiple of five is also counted as a word; while, beyond Europe, three figures are reckoned instead of five. It follows that the word "understanding," for example, which contains thirteen letters, would be charged as one word within the limits of Europe, and as two words beyond them. The date of the year, containing four figures, would be one word in Europe and two beyond; and such a compound as Aix-la-Chapelle, which would be counted as three words in Europe, might be reduced to two words, on extra-European lines, by the omission of the hyphens. The altered tariff will tend greatly to benefit the senders of short messages, by the abandonment of a *minimum* standard of twenty or some other number of words. Per word, under twenty, the charge will be somewhat higher than it would be if twenty words were sent, because of the constant of five words; but for every message of less than fifteen words the sender will gain. Above twenty words, he will pay precisely the same as under the old rates, with the exception that these were increased by steps of ten words each, while the new rates will be increased by single words. Thus a message of twenty-one words would formerly cost the same as one of thirty; but in future there will be a marked difference between them. It has been found necessary to define code language as consisting of words each of which has a definite meaning of its own, although they may be so combined as not to form any phrase or sentence which will be intelligible to persons who do not possess the key. This provision seems intended to guard against the use of so-called words coined by the sender, each syllable of which may represent an entire word, and the whole an entire sentence, to a previously-instructed recipient. In the same way proper names are excluded from code language, except as used in their obvious signification; as, otherwise, any prohibited combination of syllables might be stated to be a proper name. There is also a provision that every message should have an address of at least two words—one the name of the recipient, and the other the name of the receiving office—in addition to its text. Some of the contrivances adopted by merchants have been sanctioned, so as to avoid disputes; and one example of this is that telegrams need no longer be signed, the last word of each message being accepted, in lieu of a signature, as the character by which the message is to be identified in official communications with regard to it. The order of transmission of messages is laid down as by previous conferences, messages between Governments having priority over all others, then messages on the service of the lines, then private messages marked "urgent," and, lastly, private messages of the ordinary kind. The private messages marked "urgent" are to be charged, as at present, triple the ordinary rates; and each country is left at liberty to recognise "urgency" or not, as its administration may see fit. In England and India urgency is not recognised; but the privilege of priority is given upon the continent of Europe, and it is remarkable that the triple rate is paid upon nearly every Stock Exchange message between Paris and Berlin.

THE ELECTRIC LIGHT IN LIVERPOOL.—The preamble of the Liverpool Lighting Bill, authorising the Liverpool Corporation to raise £15,000 within the next five years, for the purpose of making experiments with electric lighting, has been proved before the House of Lords Committee on Opposed Commons' Bill, Earl Spencer being in the Chair. On July 29, the Bill was read a third time before the House of Lords.

IT has been demonstrated that a 20-light Gramme machine can feed five lights in four radial circuits, each circuit extending two and half miles from the machine.

IN the House of Commons, on July 29, Mr. Chadwick asked the Chairman of Ways and Means whether, in any private Bills passed this session, the monopoly and powers of any gas companies, in regard to gas, had been extended to electric lighting, so as to give gas companies, in case of their undertaking being purchased by any public body, a claim to be paid for any such extra privilege or monopoly; and whether he would report to the House, before any such extension of monopoly rights, was allowed in any Private Bill, whether opposed in Committee or otherwise. Mr. Raikes observed that the question was one of some importance, with regard to the various measures which had been introduced in the House during the present session by various public bodies, with a view of obtaining powers to use the electric light. As many as thirty-five such Bills had been introduced altogether in the present session. It would be in the recollection of the House that a Select Committee was appointed to consider the question of lighting by electricity, and he stipulated with the promoters that, in the event of their Bills being allowed to go forward, all the clauses which related to electric lighting should be struck out; but that if the Committee reported in favour of such powers being given to the promoters of such undertakings, the clauses should be reintroduced at a subsequent stage. The Committee, having reported adversely to the extension of such powers to gas companies, those companies were not allowed to insert clauses, relating to the electric light, in any of the Bills promoted by them; but it had been open to corporations to adopt such clauses as might be found to correspond with the recommendations of the Committee, and in three or four cases they had done so. In no cases, however, was power given to any gas company to make use of the electric light. With regard to the second part of the question, he did not think it would be in accordance with precedent to make a formal report to the House of the cases in which the extension was proposed; but, if he should continue to hold his present office, he would not fail to mention the matter to the House if any such Bill came on for second reading.

THE tour of the delegates in Scotland and the North of England was a kind of triumphal progress, the party being *fêted* at every town they visited. Many large works and places of local interest were visited by them. At Manchester, for example, the great iron factory of Messrs. Richard Johnson and Nephew was thrown open to their inspection, and all the processes of puddling, rolling, wire making, and testing were exhibited, and the party afterwards had an opportunity of descending the adjoining coal pit of Messrs. Johnson and Liveseys.

MUIRHEAD AND WINTER'S quadruplex system has, we believe, been further improved.

MR. STEARNS has taken action against two cable companies for the use of Muirhead's duplex system. The case will be decided in November. The damages laid are £220,000.

THE next International Congress will meet at Berlin in 1884.

EDISON IS STILL EDISON.—Recent reports from America state that the one obstacle met with by Mr. Edison at present to the complete success of his electric light is the high price of platinum for his incandescent coil. No other metal will answer, it seems, so Edison has sent off a dozen explorers to California, New Mexico, and South America to ransack the gulches, with orders to find a large and constant supply of platinum. If they cannot find it on the surface of the earth, they have orders to proceed straightway to the interior.

THE NEW ATLANTIC CABLES.—The *Faraday* is at Messrs. Siemens Bros.' Works, Charlton, taking in 1,000 miles of the ocean section. She is expected to make three trips before France and America are directly connected by wire.

MR. BENNET'S yacht the *Jeannette*, which recently left San Francisco for the Paleocrystic Sea, was (says the *Operator*, U.S.) provided with a complete Edison electric light apparatus for the Arctic night, and a Gramme generator.

THE TELEGRAPH IN SAXONY.—The "Imperial Postal and Telegraph Service" extends to all parts of Germany except Bavaria and Wurtemberg, which are independent of the general Government. There were employed in 1875, in the General Post Office at Berlin, 191 officials, whose salaries averaged 923 dols. 53c. per annum. Twenty-five received more than 1,000 dols. per annum. The Postmaster-General received 5,735 dols. 80c., besides a house free of rent. The Director of the Post 3,570 dols., and the Director of the Telegraph the same. The *employés* in the service numbered 36,527; average salary, 281 dols. 11c. At the 41 principal cities Postmasters received 1,904 dols. per annum, except at Berlin, where the salary was 2,500 dols.; telegraph operators of the first class, 392 dols. 70c.; second class, 285 dols. 60c.; women, 214 dols. 20c.; letter carriers, first class, 285 dols.; second class, 128 dols. 42c. These salaries are slightly increased by Christmas presents, a recognised custom. Formerly the other members of the postal and telegraph service were allowed "extras," but retrenchment has abolished nearly all those perquisites, including "free coffee." In the railway service the superintendent's salary is the highest, 1,581 dols. 68c.; few *employés* receive over 1,000 dols. per annum. Section hands are paid 144 dols. 80c. to 174 dols. 45c. per year. A certain sum is allowed to all *employés* for clothing, and some are furnished with houses and servants. Ticket agents receive 1 per cent. commission on the tickets they sell. The engineers and firemen are allowed for any savings they make in the coal and oil furnished to the trains by the Government. The salary of an engineer is 535 dols. 50c.; firemen, 300 dols.; conductor, 444 dols.; ticket agents, 723 dols. and 609 dols.; freight masters, 571 dols.

EVERY town in the settled districts of Queensland has now a telegraph office, and there is communication with the whole of the Australian colonies. A line now connects Brisbane with Normanton on the Gulf of Carpentaria, 1,425 miles distant, and before very long it is hoped that the wires will be extended to Port Darwin, and so give the Australians the advantage of duplicate land communication with the second cable which it is expected will be shortly laid. When this is done Queensland will be placed in direct communication with Europe and the West. On January 1, 1878, there were in Queensland 136 telegraph stations, 294 officers of various grades, and 40 overseers and men employed in maintenance and construction, 5,033¼ miles of line, and 6,778 miles of wire. During 1877 it appears 512,093 messages were transmitted in Queensland, an increase of 33,020 on the previous year. The intercolonial messages numbered 49,259, the international 406. The revenue was, cash receipts, £33,327; value of messages on Government service, £11,794; proportion of international messages, £141; making a total of £45,262. The expenditure was £54,198, showing a loss of £8,936. Up to the end of 1877, the expenditure on lines and stations amounted to £332,283. The charges to any station are 1s. for every ten words, exclusive of name and address, and 1d. each additional word.—*Engineering.*

THE AUDIOMETER.—Prof. Hughes has applied the audiometer to the adjustment of telephones, by connecting the latter in the circuit of the movable coil and moving the magnet to and fro, until the highest degree of sensibility is obtained.

EDISON'S quadruplex system will shortly be tried between Paris and Brussels, under the superintendence of Dr. Cornelius Herz.

IT is now proposed, that naval officers undergoing a course of torpedo instruction on board the *Vernon*, at Portsmouth, shall also be required to familiarise themselves with the practical application of electricity to war. Proper instructions will in time be appointed. The use of the electric light will be an important feature in the training, and experiments have been made with it on board the *Bloodhound*.

THE West Coast of South America cables on either side of Iquiqi, have been cut by orders of the Chilian Admiral.

THE Cape cable has been buoyed at Delgoa Bay.

CLAMOND'S NEW THERMO-PILE, having a heating surface of 20 square metres, keeps two Serrin lamps lit, each giving a light equal to from 30 to 50 gas-jets. The internal resistance is only 31 ohms; the electromotive force 218 volts, or the value of 121 Bunsen cells; and the consumption of coke is 9 kilogrammes per hour.

TRAMWAY CARS driven by electricity, according to the system of Herr Westpfahl, are proposed for Berlin.

ELECTRIC DISCHARGES.—M. Gaston Planté, in a communication to the French Academy of Sciences, recently described the results of his latest experiments on sparks from the Planté Rheostatic Machine. The length of the sparks given by this machine are proportional to the number of condensers employed. With 48 condensers charged by a Planté secondary battery of 800 pairs, he obtains brilliant sparks 0·12 metres long, and if these sparks above an insulating surface powdered with flowers of sulphur, they attain a length of even 0·15 m. In this case they form in their passage a sinuous furrow from 0·002 m. to 0·003 m. wide, and if the insulating surface be a mixture of resin with $\frac{1}{10}$th part of paraffin, they leave a very distinct bluish trace, like a pencil mark, along the middle of the furrow, which permits the course of the discharge to be easily seen. When these sparks are not so long as they can be made, closed branches or derived circuits are observable. There is also a crook or bend in the track of the discharge near the negative pole, which seems to result from the angle caused by two meeting streams of matter proceeding from the excited points, the stream leaving the positive pole being the swiftest. Arborescent forms are also discovered on lightly shaking the insulating powder. They ramify from the main tract or furrow on both sides, and help to explain the tree-like figures sometimes delineated on the skin of persons struck by lightning. These visible paths of the discharge can be easily fixed with varnish. These sparks also pierce glass and give at its surface the figures observed by M. Rees's static electricity. Quantity discharges can also be obtained by joining up the condensers in parallel circuit. These are equally brilliant, but do not traverse more than $\frac{2}{10}$ths or $\frac{3}{10}$ths of a millimetre in presenting the appearance of a very brilliant point surrounded with an aureole of flame, and projecting rays of particles drawn from the electrodes. Intermittent discharges passed through a voltameter give a rapid succession of explosions, amounting to a loud sound.

AN application on the part of the West India and Panama Company for Government subsidy to maintain their lines has been refused by the Treasury.

Review.

The Telegraph in America: its Founders, Promoters, and Noted Men. By JAMES D. REID. In memoriam of Samuel F. B. Morse and William Orton. New York: Derby Bros.

THE Americans have not yet proved themselves a great literary nation like the English, or even a mediocre literary nation like the Russians. Perhaps they have scarcely had time, or perhaps the rich stores of England overshadow their own productiveness: for it cannot be said that literature is not encouraged by Americans. They are inveterate and intelligent readers, with a strong tinge of romance in their composition, a keen hankering after dramatic effect; but if the literary ability which is necessary to make books be sadly lacking to our cousins, the material requirements are present amongst them in the highest degree. If they fail egregiously in producing the necessary spirit and genius, they are eminently successful in manufacturing the requisite paper and binding.

The Telegraph in America is a large and handsome volume, about one foot long by six inches wide by two and a half inches thick, and weighing, we should say, about fourteen pounds (one stone). If it were the custom to estimate books by their weight, this were a mighty work indeed. Similarly, if reviewers were in the habit of testing them by the quality of their paper, and the beauty of their gilding, we should have to admit it to be a consummate masterpiece. But books are to be judged neither by their material mass nor the excellence of their stationery; and we must look into the words which are so exquisitely printed on these fine toned pages, and try to gauge their value. In England it is nothing less than an expensive family Bible, or a standard Shakespeare which dares to present an appearance so magnificent as this volume; but we must not forget that, in America, where the literary matter is generally wanting, they do their best to make up for it by the mechanical form.

The origin of the book happened in this wise: On the 10th of June, 1871, the telegraphic staff of the American continent inaugurated the erection of a statue in Central Park, New York, in honour of Morse, the inventor of the electro-magnetic telegraph, and a promise was then exacted from Mr. Reid to commemorate the occasion by a suitable record. This record, which included a history of the Telegraph in America, has taken the shape of the volume in question. Mr. Reid tells us that its preparation has cost him a great deal of labour, and we believe it, for it is a large volume, and the author has evidently striven to make it as original as possible. It deals first with the origin of signals, semaphores, and telegraphs in the world; the life and struggles of Morse; the foundation of the American Magnetic Telegraph Company; the Washington and New Orleans Telegraph Company; and the score of other companies which have had their period of rise and extinction in the United States and Canada, terminating with the Great Western Union Company, the Atlantic and Pacific, and the smaller fry of telephone and exchange companies. Very finely-executed engravings of Morse, Orton, Elisha Gray, and other telegraphic celebrities, profusely illustrate the work, besides many more portraits of less famous electricians, including Edison, Mr. Pope, and Faraday, who is honoured with a vignette woodcut. The book is American, both in style and treatment, and, though it is a history of the electric telegraph, begins dramatically with a rumble of stage poetry and a gleam of enthusiastic sentiment. For example, the first chapter is headed mysteriously, "Before the Dawn-Signal Telegraphs"; and, after the inevitable stanza from the poet (descriptive of the fiery-cross bearer in the *Lady of the Lake*), the author commences his lofty epic—"The first thought of a *bon vivant* as his eye twinkles through a fresh sample of his favourite wine, which with dexterous thumb and finger he holds up to the sun, is 'How old are you?' 'Where grew the grapes which made you?' And he is but a type of an age which seems bent on tracing all things to their origin, hunting them up to their primal nest." We cannot undertake to dispute whether or not these are the first thoughts of a *bon vivant* in gloating over his favourite wine; but, had not Mr. Reid told us so, we confess we should have believed them to be very different. We did not imagine that a *bon vivant* troubled himself very much about the soil his wines grew upon, but we are ashamed to say our knowledge of *bon vivants* is extremely limited. Accepting Mr. Reid's word for it, however, we will do him the justice to appreciate the figure which he has chosen to illustrate the enquiring spirit of the age, a spirit which it would seem has permeated even to *bon vivants*.

Begun with the sentiments of a *bon vivant*, the end of the book is occupied with a lengthy account of all the public honours paid to the memory of Morse, including the flashy eloquence and glittering blasphemy of several pulpit orators. For does it not sound very like blasphemy to say "We send our words to Heaven as we send our messages to Valencia, without knowing in either case how they are transmitted; and, if the Master now walked with us as he walked the plains of Shinar long ago, perhaps we would hear Him say, 'Behold, the Kingdom of Heaven is like the lightning's message.'" Fulminated by a clerical "Jefferson Brick," the spurious glare of a sentiment like this may have been sufferable at the time, but it were better that it should have met the fate of any other squib.

Why a complete list of the subscribers to the Morse Memorial should be appended to the work, we cannot say, unless it is expected that every person whose name is there will buy a copy, or unless these individuals have some faint hope that they will in this way enter into immortality *en queue* at the coat-tails of Morse.

We have unsparingly pointed out what seem to us to be the demerits of this book; but we cannot conclude without our meed of praise too. Mr. Reid has taken, evidently, great pains to do full justice to his onerous task, and he has done so with a certain bright originality which, if it leads him to that jerky brilliance so tempting to inexperienced writers, is, at least, refreshing and eminently readable. The vast amount of historical and other information which he gives about the telegraph in America will, we are sure, be highly interesting to English and European readers.

New Patents—1879.

2962. "Joints of pipes for containing underground telegraph wires." A. M. CLARK (communicated by L. A. Herrmann). Dated July 21.

3001. "Improvements in and relating to insulated wires and cables, and in the methods of insulating, fixing, and laying the same for telegraphic and other purposes." W. MOSELEY. Dated July 23.

3023. "Telegraph wires." J. H. JOHNSON (communicated by E. Wheeler). Dated July 25.

3085. "Regulators for electric light." B. J. B. MILLS (communicated by F. Million). Dated July 30.

3132. "A new means of electrical communication between vessels at sea and the shore, or between two or more vessels at sea." S. LAURITZEN, W. C. JOHNSON, G. E. PHILLIPS. Dated August 2.

3164. "An improved method of demagnetising iron ships and composite vessels so as to prevent the deviation of the compasses. E. H. HOPKINS. Dated August 6.

3207. "An improved apparatus for reversing electric currents, chiefly designed for use in connection with submarine cables." W. R. LAKE (communicated by Count E. Siccardi). Dated August 9.

ABSTRACTS OF PUBLISHED SPECIFICATIONS.—1878.

4502. "Lighting by electricity." E. G. BREMER (communicated by T. A. Edison). Dated November 7. 6d. This describes Edison's electric candle, see TELEGRAPHIC JOURNAL for March 15.

4528. "Telephony." H. J. HADDAN (communicated by G. Black and A. M. Rosebrugh, Toronto). Dated November 8. 2d. This consists in using a "condenser" with telephones so as to utilise an ordinary telegraphic circuit for telephone work. Also in "earthing" the wire of a telephone circuit at several points, so as to diminish the injurious effects of foreign induced currents. *(Not proceeded with.)*

4529. "Telephones and telephonic call mechanism." H. J. HADDAN (communicated by A. M. Rosebrugh, Toronto). To the diaphragm is attached a small permanent cylindrical magnet having an expanded free end, which passes loosely through the centre of the core of the coil. *(Not proceeded with.)*

4559. "Mechanism, &c., for producing light and heat by electricity." C. DAVIS. Dated Nov. 11. 2d. This consists in deriving power from revolving axles or wheels by means of a cog-wheel, for the purpose of turning dynamo-electric machines to light buildings or carriages. *(Not proceeded with.)*

4568. "Electric light apparatus." J. MACKENZIE. Dated November 11. 2d. This consists in floating electrodes on mercury so as to feed the arc. By such means long electrodes can be used. *(Not proceeded with.)*

4573. "Apparatus for electro-deposition of metals and the production of light by electricity." G. ZANNI. Dated Nov. 11. 6d. This consists in constructing dynamo-electric machines with hollow cores in the fixed electro-magnets, which permit of a circulation of water to keep them cool. The armature ring is formed in segments, which can be taken apart or put together readily, giving the advantage of coiling the wire more conveniently. The current for electro-deposition is regulated at will by means of a German silver rheostat with sliding contact.

4590. "Duplex and quadruplex telegraphy." J. MUIRHEAD (communicated by A. Muirhead, J. A. Briggs, and G. Kift Winter, Madras). Dated Nov. 12. 8d. This describes Muirhead and Winter's quadruplex, fully illustrated in the TELEGRAPHIC JOURNAL for July 15.

4595. "Apparatus for generating electric currents, and an improved electric lamp." F. HEINRICHS. Dated Nov. 13. 10d. This describes an alternating and continuous current dynamo-electric machine, with a revolving armature constructed in eight or more sections. Also an electric lamp with circular or spiral carbons. With the circular carbons the arc is formed at their meeting points in the circumference of the circle which they describe. A conducting ring may be inserted between the points as one electrode.

4601. "Telegraph cables." B. HUNT (communicated by M. H. Alberger, and S. W. Pettit, of Philadelphia, U.S.). Dated Nov. 13. 6d. The cable consists of three parts, an outer tube of wrought iron, a conducting wire, with a vitreous insulator between. The wire is introduced into a tube of vitreous material, such as glass; the tube and wire are then introduced into a lap or butt-welded tube of wrought iron; the whole is then subjected to heat, and rolled into a compact whole.

4611. "Producing light, heat, and motive power by electricity." G. EDWARDS, A. NORMANDY. Dated Nov. 13. 4d. An intermittent or alternating current from a machine or battery is divided up among several primary coils, fitted with corresponding secondaries in circuit with the lamps. Light is sometimes produced by decomposing water by the current and directing the gases on a block of lime so as to produce an oxyhydrogen light. Instead of induction coils, as above, condensers may be used to feed the lamps. *(Not proceeded with.)*

4626. "Electric lighting." St. G. L. FOX. Dated November 14. 8d. Platinised, iridised, or carbonised asbestos is used for electro-pyres, which are enclosed in a globe filled with non-oxydising gas or vapour. Metal spirals are also employed. A carbon pencil floating in mercury against a carbon plate, as in Higgins's lamp, is also described. The subdivision of the current is effected by a main and branch circuits with regulators in them, and also by secondary batteries inserted in the branch circuits as stores. The patent further describes a current meter, in which the current is made by means of electro-magnetism to regulate a flow of air.

4635. "Electric lighting." E. J. C. WELCH. Dated November 15. 2d. This describes a rotating contact distributor in which the current is reversed during each revolution. *(Not proceeded with.)*

4686. "Transmitting electricity to great distances." E. U. PARDO. Dated Nov. 19. 8d. This invention consists in the substitution for cables of a large condenser acting as a reservoir of electricity and extending from point to point. It is charged by means of dynamo-machines driven by waterfalls, &c., and delivers the electricity at any required point throughout its length for lighting, heating, motive, or other purposes. The condenser consists of a long glass tube 8 or 10 inches in diameter, coated inside and out with metal-foil, and it is suitably protected and insulated from the ground. The poles of the machine are connected to the coatings.

4689. "Apparatus for producing electric light." E. J. C. Welch. Dated Nov. 19. 2d. This describes a means of regulating currents by inserting in circuit a metal resistance, which can be varied by a sliding contact moved by the current by means of electromagnetism. (*Not proceeded with.*)

4690. "Electric regulators, lamps, or candles." J. H. Johnson (communicated by A. de Méritens). Dated Nov. 19. 2d. This consists in burning electric candles under a glass dome, having an annular space between the base of dome and the candle. By this means the arc is situated in a space rendered poor in oxygen by combustion, and the carbons are said to last longer. (*Not proceeded with.*)

4693. "Apparatus for dividing electric light." A. Riemenschneider and F. S. Christensen, Denmark. Dated Nov. 19. 4d. Each lamp is shunted by a resistance coil, and the expansion of the air round the arc (which is enclosed in a glass tube), is made to regulate the length of the arc by means of its pressure on a piston arrangement. (*Not proceeded with.*)

4696. "Electric telegraph insulators." C. E. Crighton. Dated Nov. 19. 6d. This insulator was illustrated in the Telegraphic Journal.

4705. "Distributing, regulating, and applying electric currents for lighting," &c. F. J. Cheesbrough. Dated Nov. 19. 1s. This describes Sawyer's electric light. See Telegraphic Journal.

4847. "Electric lamps," in the same names, describes other parts of this apparatus.

4762. "Apparatus for generating and measuring electric currents." J. T. Sprague. Dated Nov. 22. 8d. This describes various improvements in dynamo-electric machines.

4844. "Dynamo-electric machine for producing electric currents." J. L. Pulvermacher. Dated Nov. 28. 6d. Grooved cylinders or rings of soft iron are set with electro-magnets. They are arranged so as to be concentric, and one is fixedwhile the other revolves.

4873. "Electric telegraphs." Sir C. T. Bright. Dated Nov. 29. 6d. This describes improvements in type printing telegraphs, whereby the letters are printed by inserting different resistances into the line circuit at the sending station. At the receiving a differential relay operates a local circuit which works the type-shaft.

4903. "Magnetic apparatus for curative purposes." R. Lonsdale. Dated Dec. 2. 2d. This describes the coating of strips of magnetised steel or iron with tin, copper, or zinc, and arranging them longitudinally in cloth, so that the N. and S. poles are opposed.

4921. "Electro-deposition of nickel, &c." W. R. Lake (communicated by E. Weston, of Newark, N.J.). Dated December 2. 4d. This consists in employing boracic acid, or compounds of boracic acid, in the nickel solution. Borate of nickel with other salts of nickel gives a tough and regular deposit of the metal. It also claims the manufacture of solid nickel cutlery, pens, &c.

4960. "Apparatus for generating electric currents, and for producing electric light." (Communicated by the Weston Dynamo-electric Company.) Dated Dec. 4. 10d. This describes a mode of converting an ordinary dynamo-electric machine into a multiple-circuit machine without adding any commutator to it. Also an electric torch formed of two vertical side-by-side carbon rods, with a refractory cylinder of lime, glass, &c., volatilised by the arc. Also a carbon igniter inserted between the points to establish the arc.

4961. "Magnetic appliances for curative purposes." Herbert Coombes Byshe. Dated December 4. 2d. Coating magnets with black oxide of iron by Barff's process, and making double horse-shoe magnets. (*Not proceeded with.*)

4988. "Production of electric light." S. P. Thompson, W. P. Thompson. Dated Dec. 5. 2d. This consists in forming the rotating armatures of dynamo-electric machines of silver wire instead of copper wire, thereby reducing their size in the ratio of 7 to 10. Also in doing away with or minimising the soft iron core of induction coils by forming the wire of the coil (which is usually copper) of soft iron coated with silver or copper. Also in producing electric light from two platinum or other non-corrodible electrodes with conducting feed to the arc by a rod of carbon inserted between the points, or other means. (*Not proceeded with.*)

5041. "Thermo-electric piles and generators." J. M. E. Sudre. Dated Dec. 9. 6d. This invention was fully described in the Telegraphic Journal for July 1.

5093. "Apparatus for composing, transmitting, and deciphering secret telegrams." H. J. Haddan (communicated by Messrs. G. Schacher & Co., Paris). Dated Dec. 12. 2d. This consists in a dial telegraph transmitter and printing receiver. (*Not proceeded with.*)

5136. "Watches for transmitting electrical signals." B. J. B. Mills (communicated by E. Ganelli, and F. Bardelli, Turin). Dated Dec. 14. 2d. (*Not proceeded with.*)

5181. "Telephones." C. J. Wollaston and Adam Scott. Dated Dec. 17. 4d. This describes various means of arranging telephones for speaking purposes. (*Not proceeded with.*)

5183. "Electric Lighting Apparatus." W. R. Lake (communicated by J. B. Fuller, New York). Dated Dec. 17. 8d.

5255. "Phosphorescent Powders." W. M. Brown (communicated by J. Peiffer, Colonel W. F. MacCarty, and Prince Talleyrand Perigord de Sagan, Paris). This consists in utilising daylight at night by storing it up in phosphorescent powders and emitting it in the dark. The powders are composed of carbonate and phosphate of lime, calcined Tridacna shells, and cuttle fish bone, sulphur, and colouring matter of mono-sulphur of calcium, varium, &c. The powder is rendered more brilliant by application of electricity. A phosphorescent sea-buoy is also described.

5292. "Telegraph Apparatus." S. Pitt (communicated by E. B. Welch, Cambridge, Mass., U.S.). Dated Dec. 27. 1s. 10d. This describes a step-by-step type-printing telegraph.

General Science.

Light-giving Animals.—In an interesting article on those creatures such as the glow-worm and firefly, which habitually emit light, Prof. Martin Duncan in the *Popular Service Review* shows that the luminosity is neither due to phosphor, or oxidation of the flesh, nor is accompanied by any marked heating effect. In some animals there is no photogenic apparatus; in others it is present as highly refractive cell contents; and in the *Insecta* there are aggregations of these cells into special organs, which are supplied with air-tubes, nerves, and blood. As the light comes from spots about the region where growth, the deposition of fresh protoplasm, and its differentiation into minute granules are in full operation, and as moderatively careful experiment has proved that there is no increase of temperature accompanying the light, the cause of it cannot be referred to combustion, to oxidation, or to phosphorus, but to local and then general molecular movement of intense rapidity, which can produce light waves. The phenomenon of self-luminosity in minerals, such as sulphide of barium, is also a consequence of molecular change and motion.

Purification of Mercury.—Herr Brühl gives the following effectual and rapid method for purifying mercury. The impure metal is shaken twice or three times with an equal volume of a solution containing in one litre of water 5 grms. potassium dichromate and a few c.c. of sulphuric acid. The shaking is continued each time until the red mercuric chromate first formed has disappeared and the solution has become pure green in colour. After each operation, the metal is washed in a stream of water sufficiently powerful to carry off a fine green powder which forms on its surface. It is finally washed with distilled water. A large quantity of mercury which has become almost solid from impurities is thus easily purified in the course of an afternoon. The loss of metal is trifling.

Substitute for Litmus.—Mr. G. Williams advocates the substitution of ammonium dimethylamidozobenzenesulphonate (the "orange" 3 of Porrier) for litmus in volumetric analysis. It is of an orange colour, and is turned pink by acids. It distinctly shows the presence of 1 part of sulphuric acid in 100,000 of water, whereas litmus ceases to indicate 1 part in 50,000. A great advantage it possesses over litmus is that it is not affected by carbonic acid or sulphuretted hydrogen. The best way to apply the test is, after each addition of acid from the burette, and the contents of the beaker having been well stirred, to allow one drop of the indicator to fall on the surface of the liquid.

Analysis of Caoutchouc.—According to Mr. D. Lindo, from the analysis of different samples of vulcanised rubber, the percentage of ash varied from 62·7 to 32·07, that of zinc oxide from 60·71 to 15·3, and in three samples the percentage of calcium carbonate was 11·1, 30·29 (mean of three analyses), and 30·44 (mean of two). The action of certain acids on caoutchouc was attended with distension of the material, appearance of small elevations on the surface, and crimping of the edges. These effects are due to the absorption of acid by the material, the solvent action on the mineral matter, and in some cases on the caoutchouc, the softening of the material, whereby the acid enters the pores more readily, and the small elevations are due to surface distension. Sulphuric acid, sp. gr. 1·828, decomposes the material in a few hours; hydrochloric acid, sp. gr. 1·154, turns it red and crimps it; nitric acid, sp. gr. 1·374, decomposes it rapidly. Acetic acid (63 per cent. anhydrous acid) has very little action on pure vulcanised rubber, but, when it contains mineral matter, the latter is quickly dissolved, and the mass becomes distended and crimped.

City Notes.

Old Broad Street, August 12th, 1879.

The Direct United States Cable Company (Limited).—The fourth ordinary general meeting of this Company was held at the City Terminus Hotel, Cannon Street, on Friday, August 1st, 1879, John Pender, Esq., in the chair. The chairman, in moving the adoption of the report, an abstract of which was given in our last issue, said: The expenses, though apparently larger than before, are in reality less. This is caused by the difficulties we have found in getting rid of the great incubus which was fixed on this Company at its formation, and I am afraid that these difficulties are not yet at an end. When the old Direct Company was formed, it was essentially a contractor's company, and for four years they were the only parties who got any benefit out of the Company. The contractors, or those who were more or less connected with them, hung upon the Company till the last moment. The result was that we had an arbitration suit as to the value of the shares, and we thus incurred an enormous waste of money. I believe, in one way and another, with costs, and the difference in the value of the shares, the arbitration cost this Company £21,000. If I were to express an opinion, after the experience of this arbitration, it would be, Have nothing to do with arbitrators or arbitrations, but rather trust to a court of law, and the less of that the better. But, gentlemen, it was not in our option. The arbitration was forced upon us, and I believe even those who forced it upon us would have had as much money in their pockets if the arbitration had not taken place, and they had accepted the amount we offered them for the shares, as they received at the end of the arbitration. Therefore, I consider the amount that was expended through that arbitration was simply thrown away. As I have said, we have not yet got rid of this parasite, which has clung with such tenacity, and has done so much injury to submarine telegraphic enterprise. The parties who were mainly interested in forming the old Direct Company, did so at a cost of something like £300,000 to the shareholders more than it should have cost, and, as I am informed, so rapid was the decline in the value of the shares after the formation of the Company, that even those who had anticipated getting a larger profit out of it, found that it would have been better if they had never touched it. This remark applies more particularly to the syndicate which was formed to float the Company, and sustained a loss of about half a million of money. When I last had the pleasure of addressing you, I referred to a competing company, which was then in the course of formation. The contractors who made the Direct Cable, found it impossible to raise the money in England for another Trans-Atlantic Cable, as the existing company's stock was at 50 per cent. discount; but, showing their usual energy and enterprise, and taking advantage of a period of financial excitement in France, they were fortunate in being able to form another syndicate there, and a company has been floated, with a capital of something like two millions sterling. I need not say that there is a large margin in this sum for the promoters of the company; but I suspect that, before the game is fully played out, this combination will find themselves in much the same position as did the syndicate for the old Direct Company, that is, that their property will be at a discount of 50 per cent. before twelve months have passed over. I am not blind to the fact, however, that to bring about this result it will cost us some money; but we must do our best when we find our property attacked, and attacked in a way which, I must say, is not quite in conformity with a strict business mode of dealing. I think that to go over to France, and take advantage of, I may say to a certain extent, the ignorance of the people, and put before them shares which they could buy in England for half the price they were asking, is scarcely consistent with our idea of fair dealing with the general public, and that at a time when there is no public demand for additional telegraphic communication. It is our duty, therefore, to protect our shareholders, and I trust this will be the last attempt they will be able to make to interfere with Submarine Telegraph Companies.

When competition is desirable, there is no one who will hail it with more delight than I will. I repeat now, what I said to some of the heads of the financial establishments in France who are carrying out this project: that it was an unfair thing to the French people to invite subscriptions for an enterprise, which, as I have said before, was in England at a great discount. While on this subject I will make a further remark, and that is, that submarine telegraph property is, to say the least of it, a novelty, while it has, at the same time, become a great public necessity. We have yet to learn a great deal about submarine telegraphs: for instance, as to the length of the life of a cable, and, therefore, we ought to be prepared; and I think we have shewn that we are preparing, by the way in which we have accumulated our reserve fund, and will go on accumulating it. Until we know something more of the life of the telegraph cable than we know at present, we must be prudent and cautious in dealing with it. Should telegraphs become discredited in the eyes of the public, and, should the cables fail, and the public be disinclined to subscribe for further cables, the duty to find them must devolve upon the governments. If governments therefore, wish to avoid this great responsibility they must show greater consideration than they have hitherto done for the existing submarine telegraph companies. All the governments acknowledge the great benefits which they have derived, and are deriving, from the companies; but I am afraid they do not take the broad view which they ought to take in regard to their maintenance, for they seem only too ready to grant any one concessions from which they fancy they may receive a temporary benefit, forgetting that such a policy may eventually involve them in serious outlay. I think the result of this new French cable, worked as it is likely to be by the same elements that controlled the old Direct Company will practically have the same result as befel that company, namely, that there will be no dividend for the shareholders for some years, and probably at last it will be rescued from their hands, as the Direct Company was. Before I meet you again, therefore, we may be engaged in active competition—that is, if they succeed in laying a cable. If I were to believe some of the newspaper paragraphs, I should doubt, even now, although a portion of that cable is laid, whether the money has been found for completing it; but I should think that the thing would not be commenced if they did not see a fair prospect of its being completed. Therefore, I assume that it will be completed; and, consequently, the completion of it we must meet. I need only tell you that we are fully prepared to meet that competition, and I think I may say that when we make up our minds to fight we make up our minds to win, and the result I hope will be that the present Atlantic companies will be placed on a sounder and better basis than they have hitherto enjoyed, and that the public will enjoy all the benefits of telegraphy to which they are fairly entitled. When I last had the pleasure of addressing you I mentioned that we proposed to issue debentures at 5 per cent. interest, and that the shareholders would have the first offer. We offered those debentures at 5 per cent., and gave the shareholders the opportunity of taking them up; but there was quite an inadequate response. We have now resolved to make a debenture issue at 6 per cent., as many say to us that other cable companies offer 6 per ent. Preference Shares, such as the Eastern 6 per cent. Preference Shares, and the Globe 6 per cent. Preference Shares. We have decided to adopt a similar rate of interest. I may say that in those companies both those classes of shares are at a premium at the present moment. These debentures we propose to offer to our shareholders at that rate. If the shareholders do not take them up we shall offer any balance to the public. As the proprietors may be aware, our cable has been several times injured on Brown's Bank, a locality where extensive fishing is carried on. Our cables has almost invariably been injured by the fishermen dropping their anchors and hooking it. We have issued a notice which we believe will be largely beneficial to us, to the effect that when fishermen pick up our cable and see that they must either cut it or lose their anchors, we shall, in the latter case, compensate them for their loss; they are put to a certain extent upon their honour in this matter, and I believe the result will be more satisfactory to the company in the future than it has been in the past. Gentlemen, before putting this resolution for the adoption of the report, which I will ask you to approve, I am prepared to receive any remarks which any shareholder may choose to make. The resolution is: "That the report of the directors, dated 18th July, 1879, together with the statement of accounts to the 30th June, 1879, annexed thereto, be received and adopted, and that a final dividend be now declared of 5s. per share, free of income tax, making, with the *interim* dividends already paid, a total dividend of 5 per cent. for the year ending 30th June, 1879." The resolution being seconded, in reply to Mr. Jackson, Mr. Newton, and Mr. John Varley, the chairman said: I am very much disposed to take a similar view to that which Mr. Jackson takes, but, at the same time, I do not think this is quite the time to do it. I think by the time this question of competition is settled, we shall see our way much more clearly than we do at the present time. If we are to fight, I think it as well to have powder for fighting with; therefore, I think it would be better in the meantime to allow the thing to stand as it is; but, if I saw another £100,000 in our reserve fund, I certainly would be very much disposed to recommend the board to adopt Mr. Jackson's suggestion, namely: pay off our debts, reduce our capital, and start with some money in our till. I think Mr. Jackson will probably endorse the view that I take. I approve of the suggestion, and I think, when the proper time comes, that it is a suggestion which will have very great weight with the board. What Mr. Newton says in confirmation is quite right. It is true we have invested in what is only giving us 4 per cent., and we are going to pay 6 per cent. on our debentures, and, therefore the difference is very considerable; but, at the same time, we must be prepared to meet any accident or any break taking place. We must have some money in hand, so as to be prepared to deal with a contingency like that if it is required; but the moment we are safe, that will not be required. I may tell you that in another company, over which I have the honour to preside, what Mr. Jackson has suggested was carried out, and there we wiped off a great deal of debt by applying a certain amount of the reserve fund. Therefore, I may say to Mr. Jackson that, while we are going for this £100,000 on debentures, we are at the same time wiping off a certain amount of shares; on the one hand we are reducing, while we are increasing on the other. Therefore, the difference is not the £6,000 which you point out as interest in this account, because you must pay off the debentures, and the £50,000 which we have paid the dissentient shareholders. We have got their shares, and therefore we hold as against that a very large difference. With regard to Mr. Varley's remarks about the subscription to the Conference, I dare say you are not aware that this Conference is a body of representatives from the different governments of Europe. They meet for the purpose of establishing rules for international telegraphy. Telegraphy has now become so extended that no one country can deal with telegraphy as a section. It is a question that must be dealt with as a whole, and this Conference deals with it as a whole. We have not been able, nor is it desirable that we should have any vote at these conferences. We send our delegates, but we send our delegates very much on the principle that is done in America, really to obtain counsel more than anything else, and to make them aware of the submarine telegraph wants, or if there is anything said which might interfere with telegraph property to enable those gentlemen to explain so as to satisfy them that they are imposing on submarine telegraphy rules, which would not be at all in their interest, and which would tend very much to retard submarine telegraph enterprise. The result has been that up to this time at the different Conferences which have been held, I believe the submarine telegraphs have gained immensely in strength from the opinion which is now held by the different governments of Europe in regard to submarine telegraphs. They are treated now as a very important link, in fact, as a great link and they consider them accordingly. When I mention to you that now there is close upon twenty-five millions of money invested in submarine telegraphs, and that is qnite a third of the whole of the cost of land line telegraphs throughout the world, that would give you some idea of the importance of submarine telegraphs. All the different submarine telegraph companies pay an amount so as to enable the companies to receive those delegates and show them attention, and point out to them something of the country in return for the courtesy which was extended to the deputation from this country when they went abroad. I think, after all, that that is money well spent. I am strongly of that opinion. As that is a thing which, as it only comes once in five years, after all it is not a very serious consideration, and I am of opinion that we get very good value for our money. Mr. John Varley: My point is, is it fairly to be expected as the result of this Conference that we shall get the protection for our tariff? The Chairman: Submarine telegraphs are considered as a whole. I think you will see that at the present moment for us to ask the Conference to pass any law which would make our tariffs fixed would be taking the very weapon out of our hands which we intend to wield in the competition we are likely to meet with. Therefore, we must not ask that Conference to bind us hard and fast in regard to tariffs. That we will take care of ourselves. We do not want them to interfere with us. We want to make our own tariffs. All we want is, that when we come in connection with those land-lines that we get the full benefit from them of the proportion of the traffic which is passing over those different lines. The resolution for the adoption of the report was then put and carried unanimously.

GLOBE TELEGRAPH AND TRUST COMPANY.—The ordinary general meeting of this company took place on July 31st, at the City Terminus Hotel, under the presidency of Mr. John Pender, M.P.—The accounts showed a net revenue for the year, after deduction of expenses, amounting to £160,782 7s. 5d., which, with the balance brought forward, made a total of £161,207 14s. 1d. From this amount there had been distributed in *interim* dividends the sum of £116,625. and the directors had written a further sum of £500 off the preliminary expenses account. The directors recommended payment of a final dividend for the year of 3s. per share on the preference shares, and 2s. 6d. per share on the ordinary shares (making, with the former distributions, a total dividend for the year of 6 per cent. upon the preference and 4½ per cent. upon the ordinary shares), leaving a balance of £973 14s. 1d. to be carried forward. The directors have taken 1800 additional shares of the Eastern Extension Telegraph Company in exchange for an equal number of shares of this company, half preference and half ordinary, thus increasing the holding to 45,719 shares.—In moving the adoption of the report and accounts, the Chairman said the past year's business had been of a satisfactory character, and enabled the company to pay the increased dividends of 6 per cent. upon the preference and 4½ per cent. on the ordinary shares. In regard to the future, he anticipated the company would derive considerable benefit from the extension of telegraphic communication to the Cape, and by the duplication of the Australian cable, which he trusted would be in good working order by the time they next met. On the other hand, they were threatened with the competition of another Atlantic cable, which was now in course of construction by a French company. He anticipated, however, that the same result would attend that venture as had attended a similar attempt to establish a competing line, viz., that the cable would eventually fall into the hands of one of the existing companies at half price.—Sir D. Gooch, M.P., seconded the motion.—In reply to some observations from shareholders, the Chairman said he held the opinion that submarine cables should be declared to be international property. They were now a great necessity, and Governments could do without them just as little as the general public, and he hoped some day to see the idea realised. In regard to a suggested lowering of tariffs, he believed in fair, reasonable charges. If at 3s. a word they attracted sufficient business to keep a cable employed, any reduction would mean so much loss.—The report was adopted; and the Marquis of Tweeddale and Mr. W. N. Massey, M.P., the retiring directors, having been re-elected, the proceedings terminated.

THE INDIA-RUBBER, GUTTA-PERCHA, AND TELEGRAPH WORKS COMPANY, LIMITED.—The half-yearly general meeting of this company was held on August 5th at the City Terminus Hotel, Mr. Henderson in the chair. The report stated that after deducting the usual depreciation on buildings and machinery, the net profit made by the company was £18,800. Of this sum the directors proposed to distribute an *interim* dividend of 10s. per share, being at the rate of 10 per cent. per annum, and to carry forward the balance, £3,200, to be added to the £9,049 brought forward from December, making the balance now to be carried forward £12,249. The paid-up capital of the company was now £312,000, the 3,000 unissued shares having been sold in the open market. The chairman moved the adoption of the report and the declaration of a dividend as recommended, and in doing so he said that the business of the company had been fairly good, perhaps better than they could expect considering the great depression which continued throughout the country. Every article they manufactured had felt the depression, even those the sale of which had hitherto increased during wet weather had been sparingly bought, showing that people had not the money to spend, and were making their old things last longer than usual. In the cable department they had been better employed, and this had to some extent made up for the decline in their general sales. During the past six months the price of india-rubber had advanced, but owing to the foresight of their manager, they held a considerable stock bought at the old prices. Mr. Silver seconded the motion, which was unanimously agreed to.

THE SUBMARINE TELEGRAPH COMPANY.—The report of the directors of this Company to be submitted to the meeting to be held at the City Terminus Hotel, Cannon Street, London, on Wednesday, the 13th day of August, 1879, states the accounts for the six months ending 30th June, 1879, show a result which enables the directors to add the usual proportion of the receipts to the reserve fund, and to recommend a dividend at the rate of 17½ per cent. per annum. The dividend for the corresponding period of the year 1878 was at the rate of 17 per cent. per annum. The directors have established, in concert with the German Union Telegraph Company, a duplex system of telegraphy on a wire between London and Emden for the transmission of messages passing over the special wire erected by that Company between Emden and Vienna. The proportion of the cost of the new system is £302 10s. 2d. as charged in the accounts. A Telegraph Conference has just been held in London, at which the delegates of the various States revised the rules and regulations affecting the international service, and agreed to substitute a word-tariff in Europe in place of the present system of charging the same sum for a message containing twenty words, or less than twenty words. All the cables belonging to, and worked by, the Company, are at present in good order. The reserve fund now amounts to £67,564.

THE CUBA SUBMARINE TELEGRAPH COMPANY, LIMITED.—The report of the directors for the half-year ending 30th June, 1879, to be presented at the sixteenth ordinary general meeting of shareholders to be held on the 20th day of August, 1879, states that the gross receipts, including the balance brought from last account, amount to £22,360 14s. 5d., and the gross expenditure to £9,086 1s. 11d., leaving a sum of £13,274 12s. 6d. to the credit of Revenue Account. The above amount of £9,086 1s. 11d. includes, however, the sum of £5,756 1s. 10d., the cost of the repair of the Cienfuegos-Santiago section of the original cable, the ordinary expenses being £3,330 0s. 1d. This repair was completed in March last, but the directors regret to report that the cable again broke down in the end of June, off Turquino. On the recommendation of the Company's engineer in Cuba, Mr. Keith, it has been decided to slightly alter the course of the cable at this point by carrying it out into deeper water, and this will be effected at the same time as the repair, as soon as the cable and stores which are now being got ready arrive. The directors have considered it advisable to place £4,100 to the credit of the Reserve Fund, increasing that fund to £23,011 5s. 0d. The balance of revenue, after providing for the dividend on the preference shares, will admit of a dividend on the ordinary shares at the rate of 6 per cent. per annum, leaving the sum of £1,374 12s. 6d. to be carried forward to the current half-year's account, and they recommend that dividends be declared accordingly, payable 21st proximo. The directors have to report that there has been a falling off in the local traffic, partly attributable to the competition of the Government's land lines and partly to commercial depression. The through traffic, however, continues good, although it was considerably affected during last month and part of the present one, by interruptions on the West India and Panama Company's system.

WE are informed by the Indo-European Telegraph Company that telegraphic communication has been extended to Malacca *via* the Madras-Penang Cable, and messages are accepted by this Company's route from London and the provinces at the rate of 6s. 3d. per word.

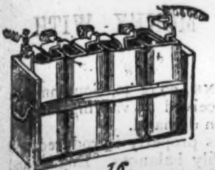
THE Anglo-American Telegraph Company's cable laid in 1869, between Brest, St. Pierre, and Duxbury, which was broken in February last off St. Pierre, has been repaired, and is now in good working order throughout. This repair restores direct telegraphic communication between France and the United States.

The following are the final quotations of telegraphs:—Anglo-American, Limited, 52¾-53¼; Ditto, Preferred, 81¼-81¾; Ditto, Deferred, 26-26½; Brazilian Submarine, Limited, 6⅞-7⅛; Cuba, Limited, 7¾-8¼; Cuba, Limited, 10 per cent. Preference, 15½-16½; Direct Spanish, Limited, 1¾-2¼; Direct Spanish, 10 per cent. Preference, 11¼-11¾; Direct United States Cable, Limited, 1877, 10¼-10½; Eastern, Limited, 7⅜-7⅞; Eastern, 6 per cent. Debentures repayable October, 1883, 105-108; Eastern 5 per cent. Debentures repayable August, 1878, 101-103; Eastern, 6 per cent. Preference, 11¾-12; Eastern Extension, Australasian and China Limited, 7¾-8; Eastern Extension, 6 per cent. Debenture, repayable February, 1891, 105-108; German Union Telegraph and Trust, 7½-8; Globe Telegraph and Trust, Limited, 4⅞-5⅛; Globe, 6 per cent. Preference, 11-11¼; Great Northern, 8⅜-8⅝; Indo-European, Limited, 21-22; Mediterranean Extension, Limited, 2½-3; Mediterranean Extension, 8 per cent. Preference, 9-9½; Reuter's, Limited, 9-10; Submarine, 230-235; Submarine Scrip, 2-2¼; West Coast of America, Limited, 1-1½; West India and Panama, Limited, 1⅜-1⅞; Ditto, 6 per cent. First Preference 7¾-8; Ditto, ditto, Second Preference, 7½-7¾; Western and Brazilian, Limited, 3-3½; Ditto, 6 per cent. Debentures "A," 94-98, Ditto, ditto, ditto, "B," 87-92; Western Union of U.S. 7 per cent., 1 Mortgage (Building) Bonds, 118-122; Ditto, 6 per cent. Sterling Bonds, 107-109; Telegraph Construction and Maintenance, Limited, 30¼-30¾; Ditto, 6 per cent. Bonds, 106-108; Ditto, Second Bonus Trust Certificates, 2½-2¾; India Rubber Co., 12¾-13¼; Ditto, 6 per cent. Debenture, 106-109.

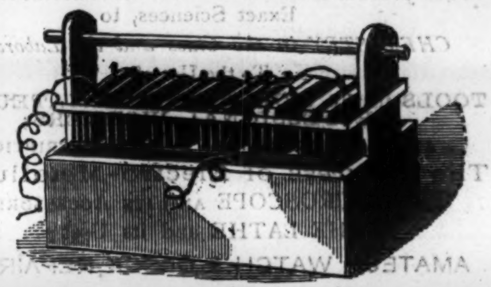
THE SUBMARINE TELEGRAPH COMPANY LIMITED.—Since writing the above notes, the half-yearly ordinary meeting of this Company has been held, Sir James Carmichael presiding. The report of the directors for the half-year ending 30th June last recommended a dividend at the rate of 17½ per cent. per annum, and to add the usual proportion of the receipts to the reserve fund. It also stated the directors had established, in concert with the German Union Telegraph Company, a duplex system of telegraphy on a wire between London and Emden for the transmission of messages passing over the special wire erected by the company between Emden and Vienna.—The Chairman, in moving the adoption of the report, congratulated the shareholders on the balance sheet, which, while showing a slight increase in traffic, did not show a corresponding increase in the expenditure. With regard to the alteration of tariff contemplated, the shareholders were aware that the directors had from the commencement of the company always been advocates of reasonable rates. Many years ago, he (the Chairman) endeavoured to obtain a reduction of the present rates from the French Government, and an assimilation of the differential rates from Liverpool, Glasgow, &c., to the Continent. The French Administration did not see their way to meet the wishes of the company. At a late telegraph conference in London there was an almost general expression of opinion in favour of a word tariff. Personally speaking, he would have preferred taking a more medium course, commencing with a ten-word rate. This was advocated by the French delegates, but the general opinion was in favour of a substitution of an actual word rate. Such being the case, it became their duty to endeavour to carry out that intention in the most efficient manner for the interests both of the public and shareholders. He had only just returned from France, where he found that the operation of the word-rate had led to a considerable increase, both in receipts and in the number of messages sent. With an increase of business they must, of course, look to an increase in the expenditure, as a large additional number of messages would mean an increased number of clerks and instruments, and the probable use of the duplex instrument for many of their lines. In any case, they were not likely to require new wires for many years to come, and, when they did, there was an ample reserve fund to supply them from.—Mr. Capper seconded the motion, which was carried unanimously.—After the re-election of the retiring directors and auditors, the meeting closed with the usual compliment to the chairman and directors.

ELECTRIC LIGHT APPARATUS,

FOR EXPERIMENTS, &c.


16

15



No. 1 Set—Price £5.—This Apparatus consists of a self-regulating Electric Lamp, with silvered copper reflector; a powerful Galvanic Battery of 10 cells, with sufficient acids, &c., to work it several times, and all the necessary connections and conducting wires.

No. 2 Set—Price £10.—This Set is similar to No. 1, but the battery consists of 30 cells, and is sapable of lighting up brilliantly a moderate sized shop or room.

No. 3 Set—Price £20.—This set is similar to the preceding, but the battery consists of 50 large cized cells, and the illuminating power is much greater.

APPARATUS FOR USE WITH THE ELECTRIC LIGHT.

Batteries, Carbons, Conducting Wires, Regulators, &c.

Agents for HICKLEY'S PATENT TELEPHONES, price £2 10s. per pair.

PRICE LISTS of SCIENTIFIC APPARATUS and CHEMICALS, Post Free 3d. each.

SPECIAL QUOTATIONS TO THE TRADE AND LARGE CONSUMERS.

M. JACKSON & CO.

(J. ORME & H. M. CAPNER.)

65, BARBICAN, LONDON.

ZANNI & BRIDGER,

GNETIC AND ELECTRIC TELEGRAPH WORKS,

1, JAMES STREET, OLD STREET, LONDON, E.C.

Magneto-Electric Bell Pulls, entirely dispensing with the use of battery; very useful for *Private Houses* for ringing from *House to Stable;* for *Ship's Cabin;* also made larger to ring gongs for Mines, &c. Used with great success with the *Telephone.*

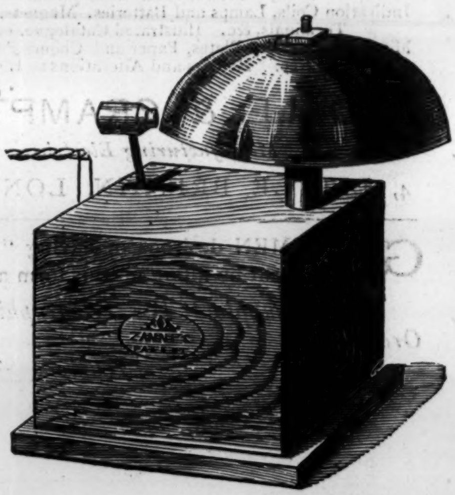
Magneto and Electric Alphabetical Dial Instrument.

Patent Morse Instrument to work without Battery.

Batteries and all kinds of Electric Bells, Buttons, Indicating Tablets, with the latest Improvements.

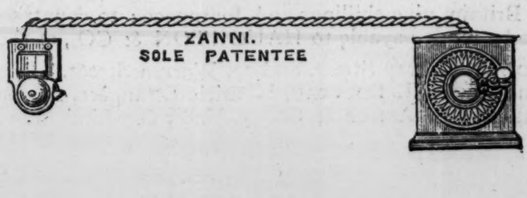
CONSULTING ELECTRICIAN—G. ZANNI.

Liberal Discount to Trade.



Bellpull for Block System.

Gong for Block System.



DESIGN AND WORK:

AN ILLUSTRATED JOURNAL OF INVENTIONS, MANUFACTURES, SCIENCE & ART.

Office: 41, Tavistock St., Covent Garden, London, W.C.

This Journal is devoted to the Advancement of the Exact Sciences, to
CHEMISTRY in the Class and the Laboratory,
To the Use of
TOOLS in the WORKSHOPS of AMATEUR and PROFESSIONAL WORKERS;
AND MACHINERY OF EVERY DESCRIPTION.
The Progress of Electro-Metallurgy;
THE MICROSCOPE AND ITS ACCESSORIES;
THE LATHE and its Uses;
AMATEUR WATCH & CLOCK REPAIRING.
Physical Science in General,
With PHOTOGRAPHY, TELEPHONY, and PHONOGRAPHY.
The Organ, Violin, Harmonium, and other Musical Instruments.
British and Foreign Inventions, Science and Art.
Electricity and Electrical Apparatus.
ASTRONOMY AND ASTRONOMICAL INSTRUMENTS.
Intercommunication between Readers on all Subjects of Genuine Interest, &c., &c.

Weekly, 2d.; by post, 2½d. Monthly parts, 9d., and by post, 1s. Quarterly subscription, post free, 2s. 9d.

ELECTRICAL, SCIENTIFIC, AND PHOTOGRAPHIC APPARATUS

FOR AMATEURS AND THE TRADE.

Electric Bells, Indicators, and Automatic Switches.

Microphones from 1s. 6d.
Indication Coils, Lamps and Batteries, Magnets, Wires, Carbons, Terminals, &c. Illustrated Catalogue, one stamp.
Most Sensitive Dry Plates, Paper and Chemicals. Photographic List free. Repairs and Alterations to Instruments.

DALE & CRAMPTON,
Manufacturing Electricians,
4, LITTLE BRITAIN, LONDON, E.C.

THE BIRKBECK BUILDING SOCIETY'S ANNUAL RECEIPTS EXCEED FOUR MILLIONS.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH,

With Immediate Possession and no Rent to pay.—Apply at the Office of the BIRKBECK BUILDING SOCIETY, 29 & 30, Southampton Buildings, Chancery Lane.

HOW TO PURCHASE A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH,

With Immediate Possession, either for Building or Gardening purposes.—Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, 29 and 30, Southampton Buildings, Chancery Lane.

HOW TO INVEST YOUR MONEY WITH SAFETY.

Apply at the Office of the BIRKBECK BANK, 29 & 30, Southampton Buildings, Chancery Lane. Deposits received at varying rates of interest for stated periods, or repayable on demand.

Current Accounts opened with Persons properly introduced, and Interest allowed off the minimum monthly balances. English and Foreign Stocks and Shares purchased and sold, and Advances made thereon.

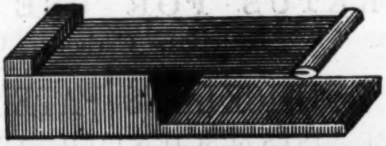
Office hours from 10 to 4; except on Saturdays, when the Bank closes at 2 o'clock. On Mondays the Bank is open until 9 o'clock in the Evening.

A Pamphlet, with full particulars, may be had on application.

FRANCIS RAVENSCROFT, Manager.

POCKET SOUNDERS FOR LEARNING MORSE CODE

Of Superior Make. In Brass, 8d. each. Nickel Plated, 1s. each



W. STONE,
44, *Gloucester St., Queen's Square, Bloomsbury.*

Le Numéro: 50 centimes.

L'Electricite Revue Scientifique Illustree.

Paraissant le 5 et le 20 de chaque mois.

BEAUX-ARTS—INDUSTRIE—MÉDECINE—ART MILITAIRE MARINE.

Abonnements: Paris et Déparements, 12 fr.; Etranger, le port en sus.
Administration et Rédaction: 16, Rue du Croissant, Paris.

GENTLEMEN desirous of having "THE TELEGRAPHIC JOURNAL" forwarded to them regularly can have it sent by filling up this form and returning it to the Publishers, 10, PATERNOSTER ROW, LONDON, E.C.

Please supply "The Telegraphic Journal" for the year 187 *, for which I inclose Post Office Order for*

*Name*______________________________

*Address*______________________________

*Date*__________________

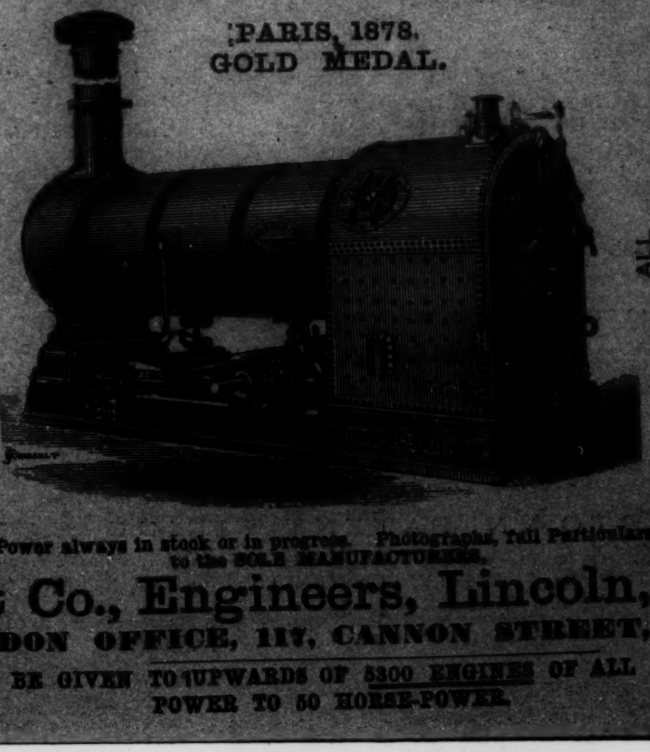
Subscription: Post Free in Britain, nine shillings and fourpence; to countries in Postal Union, ten shillings and fourpence. P.O. Orders to be made payable to HAUGHTON & CO., at the Chief Office.

NEW YORK: D. VAN NOSTRAND, 23, Murray Street, and 27, Warren Street. PARIS: M. BREGUET, 39, Quai de l'Horloge; Madame VEUVE J. BOYVEAU, Librairie Etrangère, 22, Rue de la Banque.
BERLIN: A. ASHER & CO., 5, Unter den Linden.

EDWARD PATERSON,
MANUFACTURING ELECTRICIAN,
3, BEDFORD COURT, COVENT GARDEN.
STEAM WORKS—GRAY'S INN ROAD.
EXPERIMENTS IN ELECTRIC LIGHTING CARRIED OUT.
PATERSON'S ELECTRIC LAMP & BATTERY, for experiments with the Electric Light, £5 5s.
APPARATUS FOR SCIENCE SCHOOLS AND LECTURE PURPOSES.
RUHMKORFF COILS AND VACUUM TUBES.—Purchasers of more than £5 value of these can see them tested before purchasing.
Telephones, Telephone Calls, Telephone Wires, Electric Bells, Indicators, and Pushes.
SIEMENS' & GRAMMES' DYNAMO-MACHINE and LAMPS on Hire.
PROFESSOR S. P. THOMPSON'S LANTERN SLIDE GALVANOMETER, &c.
New Illustrated Catalogue of 60 pages, post free 6 stamps.
Electric Light Apparatus for Sale as good as new. Siemens' Dynamo-Machine, £60. Siemens' Lamp, £14. Halle's Lamp, £10. Serrin's Lamp, £13.

M. SADLER,
INVENTOR OF THE
UPRIGHT MAGNETIC MACHINE,
So universally used by the Medical Profession,
MANUFACTURER OF
Electrical, Galvanic, Magnetic, Chemical, Photographic and Pneumatic Apparatus.
Electric Bells and Indicators of every description.
For Hotels, Warehouses, Manufactories, Mines, and Domestic and General Use.
19, ASTON STREET, BIRMINGHAM.

THE PATENT ROBEY "ELECTRIC LIGHT" ENGINE.
PARIS, 1878.
GOLD MEDAL.
SOME OF THE ADVANTAGES OF THIS ENGINE ARE:—
Small First Cost.
Saving of Time and Expense in Fixing.
No expensive Foundations, Brick Chimney, or separate Boiler House being required.
Ease, Safety, and Economy in Working.
Great Economy in Fuel.



ALL
ROBEY & Co.'s
ELECTRIC LIGHT ENGINES
Are Fitted with their
Patent High Speed Governor,
WHICH ENSURES
The Greatest Regularity and Steadiness in Working.
Engines of 4 to 200 Horse-Power always in stock or in progress. Photographs, Full Particulars and Prices on application to the SOLE MANUFACTURERS.
ROBEY & Co., Engineers, Lincoln, England;
LONDON OFFICE, 117, CANNON STREET, E.C.
☞ REFERENCES CAN BE GIVEN TO UPWARDS OF 5300 ENGINES OF ALL SIZES FROM 2 HORSE-POWER TO 50 HORSE-POWER.

W. M. WARDEN & Co.,

TELEGRAPH ENGINEERS AND CONTRACTORS,

27, GREAT GEORGE STREET, WESTMINSTER, S.W.

Contractors for the Erection and Complete Equipment of Lines of Telegraph, and for the Supply of Telegraph Stores.

MANUFACTURERS OF IRON POLES AND TELEGRAPH WIRE.

ALSO OF EVERY DESCRIPTION OF

TELEGRAPH INSTRUMENTS AND APPARATUS.

W. M. WARDEN, of the late Firm of Warden, Muirhead and Clark.

HENRY WIGGIN & COMPANY,

(Late EVANS & ASKIN,)

COBALT AND NICKEL REFINERS AND GERMAN SILVER MANUFACTURERS,

BIRMINGHAM.

Anodes supplied for Nickel Plating, of any shape or dimensions.

INDIA-RUBBER, GUTTA-PERCHA, AND TELEGRAPH WORKS COMPANY, LIMITED.

Offices and Warehouses: 106 & 100, CANNON ST., LONDON, E.C.

Works: Silvertown, Essex; Persan Beaumont, France.

TELEGRAPH ENGINEERS AND MANUFACTURERS OF

CABLES.—Submarine, Subterranean, and Aërial.

WIRE.—India-Rubber and Gutta-Percha covered in all gauges.

INSTRUMENTS.—"Morse" Inkers, Single Needle, Wheatstone's Alphabetical, Preece's & Walker's system of Semaphore "Block" Instruments, Bells, Resistance Coils, Sir W. Thomson's and other Galvanometers, Condensers, Testing Instruments, &c.

BATTERIES.—SOLE MANUFACTURERS FOR GREAT BRITAIN, IRELAND, AND THE COLONIES OF THE CELEBRATED LECLANCHE BATTERY, which has received the most favourable reports from Telegraph Engineers, and is in general use on English and Continental Railways. As a Battery for all Telegraphic purposes it is undoubtedly pre-eminent. All other kinds of Batteries also manufactured. Ebonite Cells, Carbon Plates, &c.

The Leclanché is the best Medical Battery.

INSULATORS.—Ebonite, Porcelain, Brownware, &c.

Manufacturers of the most Improved Apparatus for RAILWAY BLOCK-SIGNALLING.

SEMAPHORE REPEATERS "LIGHT" INDICATORS, AND WALKER'S "PASSENGER AND GUARD" COMMUNICATOR.

TELEGRAPH STORES AND APPARATUS OF EVERY DESCRIPTION.

TORPEDO APPARATUS.

THE INDIA-RUBBER, GUTTA-PERCHA, & TELEGRAPH WORKS COMPANY (Limited) are Patentees and Manufacturers of a Complete System of Torpedoes for Harbour and Coast Defence, and of the

SILVERTOWN PATENT FIRING BATTERY,

A Constant Battery for Mining and Blasting Purposes.

ONTRACTS ENTERED INTO for the SUPPLY, CONSTRUCTION, and MAINTENANCE of TELEGRAPH LINES.

London: Printed for the Proprietor by H. Blacklock & Co., Allen Street, Goswell Road, E.C.—August 15, 1879.